McGRAW-HILL DIGEST

ENGINEERING • INDUSTRY • SCIENCE • BUSINESS

OCTOBER 1947

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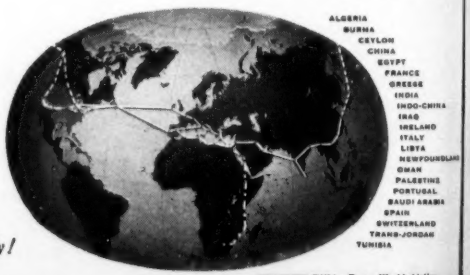

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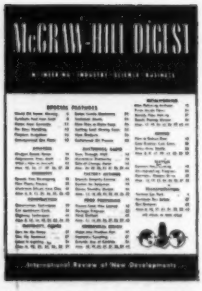

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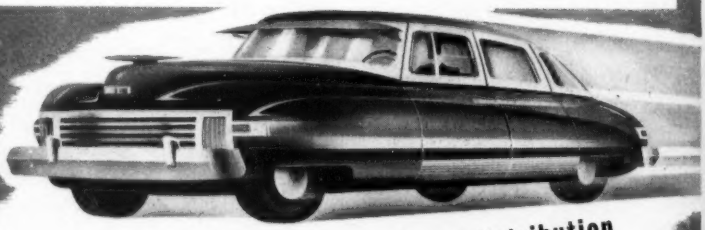

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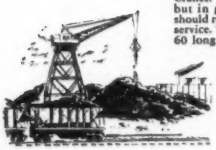

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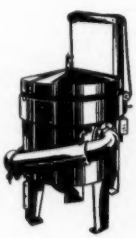

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Sodium Pentothal
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Clamps
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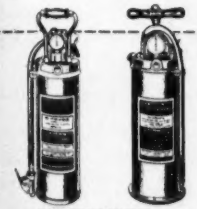
On these pages are shown only a few of the many thousands of items for sale. Instruct your U. S. buying agent to find out what else is being offered—then act immediately on his information. He knows how and where to buy, but will need your authorization to make appropriate inspection and arrange for export shipment.



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Images can be stored on dielectric target by electron bombardment and reproduced.

Electronic Memory Tube

Images can be put on dielectric screen, held for a time, and reproduced by scanning. Device uses electron beams for writing, holding, reading

Images are stored by an experimentally developed electronic tube. It will rapidly record electrical signals and hold them for any desired period, and it can be used for simultaneous multiple reproduction of the recorded signals. Applications include use in simultaneous multicolor and three-dimensional presentation of radar or sonar data, daylight viewing, automatic recording and reproducing of electrical transients, and storing and reading binary numbers of electronic digital computers.

Operation of the tube is based on secondary emission properties of a dielectric target bombarded by electrons. Three electron beams of different energies scan the target. One beam writes or paints the stored image or picture, another holds the recorded information, and the third reads or electrically reproduces the information.

A pattern of charges deposited on the surface of a good insulator can be retained for a long period. Deterioration occurs from leakage of the charges over the surface and through the insulator, or from irradiation of the surface by a corpuscular beam or electromagnetic waves. A dielectric of extremely high resistance minimizes leakage.

To generate electric signals which correspond to the stored-charge pattern, it is necessary to explore the surface of the dielectric point by point. This is most conveniently done by scanning the surface with a focused electron beam, which normally "erases" the picture in a few scans. In the new tube, however, erasure is neutralized by constant bombardment of the surface by a stream of electrons of of suitable energy, continuously regenerating the picture.

The basic memory tube is shown schematically in the diagram. The cathode-ray type must have at least two independent sources of electrons and a suitable dielectric target on which the charge pat-

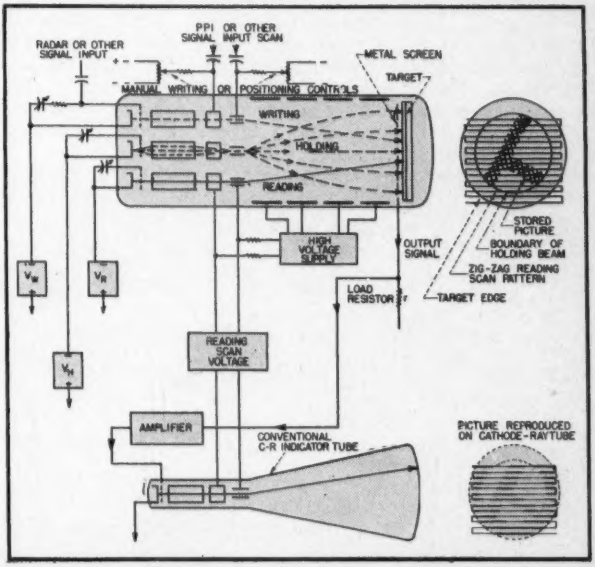
tern can be stored. In front of the target is a metal screen or collector. The velocity of the electrons while approaching the target is determined by the potential difference between the screen and the particular cathode from which the electrons originate.

Writing is done with a focused beam of relatively high current density. This beam writes the picture by being directed through a deflection system to different parts of the target and by being modulated in intensity or velocity. A pattern can be copied stroke by stroke with a writing stylus to produce vertical and horizontal deflection signals. Elements of the target explored by the writing beam lose or accumulate electrons and assume a potential different from that of the unexplored part of the target surface.

Holding of the image is accomplished by a diffused beam bombarding the entire surface or by a focused beam scanning the surface.

The reading beam is a focused beam of constant intensity that scans the dielectric surface. It generates secondary emission current, the instantaneous magnitude of which depends upon the potential of the particular element of the target being scanned. This secondary current is partially intercepted by the metal screen in front of the dielectric target, and the current flowing to the screen constitutes the electrical output of the device.

Output current is fed through an amplifier to the grid of a conventional cathode-ray indicator tube, the electron beam of which is made to scan in the same manner as the reading beam of the memory tube. Intensity modulation of the scanning beam is converted into light intensity variation over surface of the cathode-ray screen, and the electrical picture painted on surface of storage tube target becomes visible on the face of indicator tube. —ELECTRONICS



Schematic circuit of basic memory tube.

ON-SPOT RADIO PHOTOS

Photographic prints produced in a specially equipped automobile immediately after exposure were radio transmitted to editor's desk at *N. Y. Daily Mirror* 8 min. after occurrence of event photographed. This method probably will become standard for pictorial news coverage.

Standard picture transmitter and receiver were used in automobile and at newspaper office. —ELECTRONICS

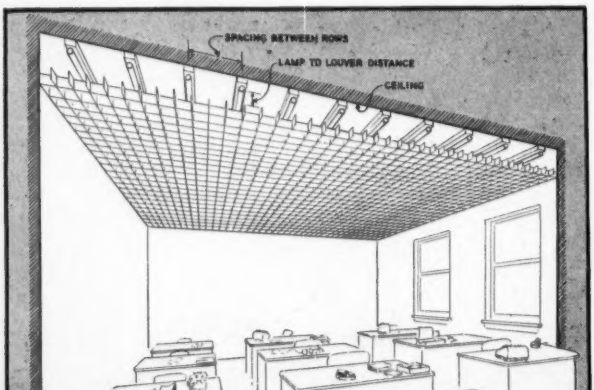
New Lighting Technique

By placing fluorescent lamps on ceiling and suspending overall gridwork of louvers below, effective, pleasing, inconspicuous illumination is achieved

Comfortable illumination, with a "clean" ceiling which approaches the goal of inconspicuous lighting is achieved with the new "louverall" technique. Applicable to general or specialized interior lighting, it consists of parallel rows of fluorescent lamps on the ceiling with an overall gridwork of louvers suspended below the lamps. Most famous installation is in the auditorium of the United Nations at Lake Success, N. Y. (McG-H Digest, Jan., p. 10). But the technique also is being used for small conference rooms, retail stores, and business places such as an airline office.

The flexibility and versatility of this lighting treatment frequently appeal to owner, architect, and electrical contractor alike. Groups of lamps can be switched on separately for several levels of illumination, yet room looks better than with conventional fixtures when some are turned off. Future increase in light intensity can be attained by adding rows of lamps. Pleasing brightness patterns in the louver itself can be achieved through spacing relationships and use of reflectors. Colored lamps may be employed to create pleasing color combinations on louver surfaces and still give essentially white light in the room itself. Filament spotlights mounted above louvers will produce added foot candles which give extra attraction value to specific merchandise displays in stores. The louvers help to conceal pipes, ducts, and other unsightly elements on or near ceiling. Mounting of louvers in removable sections gives easy access to lights. Many variations are possible, such as mounting louvers flush with the ceiling, suspending lamps from ceiling, and use of irregular shaped louvers.

Distance between louvers and height of the "blade" determine the extent to which lamps are shielded from view. Where visual tasks are critical and prolonged as in offices and schools, louvers should shield the broadside view of fluorescent lamps through an angle from



Principle of louverall system in perhaps its simplest form — lamp channels on ceiling with separately fabricated louver sections suspended below.

horizontal down to 45 deg. Tube brightness is lower when lamps are viewed lengthwise, so shielding down to 30 deg. is acceptable for that direction. Shielding requirements can be less for low-brightness fluorescents, such as the 40-watt T-17 and Slimline lamps operated at 100 or 120 milliamp. There is more latitude in stores because shoppers' vision is not concentrated for long periods.

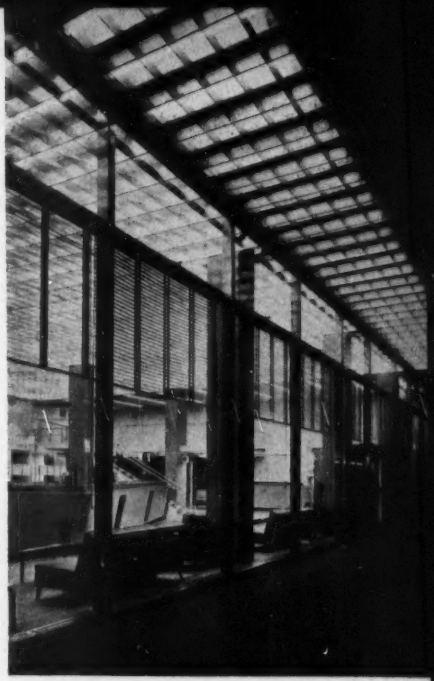
If strips 4-in. deep, for example, are installed on 4-in. centers in both directions, lamps above would be obscured to 45 deg. below horizontal. If strips are 8-in apart, the angle is about 27 deg. Spacing of continuous single rows of different size 4500° White fluorescent lamps for 35, 50, and 75 footcandles is given in accompanying table. For 3500° White lamps, spacing can be increased about 10% for 40-watt T-12 lamp and 5% for 100-watt T-17 and 96-in. Slimline. For essentially uniform louver brightness, between rows of lamps, the louvers should be suspended below the lamp a distance equal to about two-thirds the spacing between rows.

White ceiling finish gives better performance than dark. Reflectors can be used around lamps if there is no flat ceiling above or if particular conditions make it easier to clean reflectors than ceiling. Nonuniformity of brightness however, may be objectionable in this case. —ELECTRICAL CONST. & MAINT.

Spacing Between Continuous Rows for Louverall Installations*

Footcandles	35			50			75		
Utilization	.20	.30	.40	.20	.30	.40	.20	.30	.40
Lamp	Inches Between Continuous Rows								
40-Watt 48-inch T-12	23	35	47	16	25	33	11	16	21
60-inch T-17	19	28	37	13	20	27	9	13	17
100-Watt 60-inch T-17	36	54	71	25	37	50	17	25	33
Slimline 96-inch T-8 at 200 ma.	17	26	34	12	18	24	8	12	16

* Using 4500° White lamps. Footcandles are average in service, based on a maintenance factor of 0.65.



Ceiling of light is achieved by new louverall system in TWA office, Chicago. Twenty-nine continuous rows of 6- and 8-ft. 4500° White Slimline lamps on about 2-ft. centers are shielded by aluminum louvers.

OIL IMPROVES RUBBER

Silicone oil improves heat, chemical, and weather resistance of rubber. The oil can be mixed with carbon black used to strengthen the rubber or can be added directly to the compound during processing. The silicone oil rubber has increased abrasion-resistance qualities, can be extruded faster and more smoothly. Tests prove that silicone oil had less effect on rubber compounded with channel black and with the finer furnace blacks. —CHEMICAL ENGRG.

Cold Steel Formed by Flowing

Revolutionary cold-extrusion technique, developed by Germans, has been improved by U. S. firm, which also brazes large aluminum sheets by new method

Vast possibilities for making many different products at greatly reduced cost were opened up by the technique of extruding cold steel, developed by the Germans. By this means, cold steel is made to flow under pressure in the same manner that tin, lead, copper, brass, and aluminum have been extruded. Cold extrusion is so accurate that it often can eliminate need for machining. Heintz Mfg. Co. has been perfecting this process, and it soon will be ready for commercial use.

As developed by the Germans, cold extrusion is done with mild, low-carbon steel. The material is formed by pressure of a punch in an open die; a shoulder on the punch forces the steel through the die opening.

The German's big discovery was the method of lubricating the steel so it would flow through the die. This was done by a variation of the well-known bonderizing process, which chemically transforms the surface of steel into an insoluble phosphate of the iron. The coating holds lubricant so as to form a film between steel and die. Among lubricants used by the Germans were rapeseed oil, tallow, fatty soap, and palm oil. Pressures up to 230,000 psi. were used in extruding such items as oleo struts for airplane shock absorbers, steel cartridge cases, pipe, wire. Heintz has reduced required pressures to as low as 30,000 psi. The company hopes to extend the applications—perhaps even so far as to make pistons for engines. It already has turned out precision pieces accurate to 0.001 in.

New Brazing Method—Another Heintz development is a new means of brazing aluminum sheets together. It is in full-scale use in production of an evaporator for home freezers. The evaporator consists of two flat pieces of metal, each containing a network of shallow channels. These pieces are brazed together to form the inner and outer walls of the evaporator. The refrigerating action is obtained by permitting a coolant to expand from a liquid to a gas inside these channels.

On one side of the aluminum sheet is a layer of aluminum alloy with a slightly lower melting point than the rest of the sheet. The two sheets are placed together with the alloy face on the inner side. Then the assembly is heated to the point where the alloy will melt and fuse, but not hot enough to melt the sheets themselves. Heat is transferred to the sheets through a metal die designed to fit the sheet, at fusing temperature of 1080-1140° F. —BUSINESS WEEK

SPEEDS ORDER ASSEMBLY—There is no waste motion at this Thompson Products, Inc., order-form assembly table (rear). As forms are duplicated by machine, operator places them in proper compartment of double-decked, semicircular assembly jig. Stacking fixture (arrow) permits two-handed collection. After assembly, forms are placed in files (foreground) for distribution to proper departments. —FACTORY

BURNING COAL IN MINE PROVES FEASIBLE

Underground gasification of coal is feasible for commercial production of power and possibly synthetic liquid fuels. This conclusion has been reached by technical men who studied the results of the experiment by Alabama Power Co. and U. S. Bureau of Mines.

Although the light overburden caused loss of heat and pressure in burnouts, the "make" gas produced ranged from 50 to 221 Btu. in calorific value. With heavier overburden and increased air blast, production of 150 Btu. gas would be a simple matter. Such gas would operate a large nearby power plant. Oil chemists also believe that further research might develop an entirely new concept in production of synthetic liquid fuels. —POWER

SKIDS BRIDGE TO NEW SITE

Without interruption of traffic, a 48-ft., 100-ton, double-track, through-plate girder railroad bridge was moved 125 ft. to new location on Denver & Rio Grande Western R.R. Two locomotive cranes picked up bridge, skidded it along greased rails of main line, and lifted it into position.

Move was made in three jumps to take advantage of traffic-free intervals. Two moves from original position to temporary seats alongside, and from second set of seats to final position, each required 4¾ hr. Structure was skidded along main line in 2 hr.

Before shift was made, channel was cut and abutments poured at new location while track was supported on timber falsework. —CONSTRUCTION METHODS

NEW IN MEDICINE

A new form of streptomycin—*Streptomyces II-Bikinensis*—has been discovered on Bikini Atoll, scene of recent atom bomb tests. Derived from soil organ-

SAFE LIGHTING—Because dimly lighted streets are a direct cause of traffic accidents and a breeding ground for crime, Albany, N. Y., has installed highly effective illumination. Two 15,000-lumen lights, 30 ft. high on curb standards spaced 80 ft. apart, give average 2.5 ft.-candles on street 68 to 104 ft. wide. —ELECTRICAL WORLD

isms, the new drug has been found to be twice as powerful as streptomycin in destroying tuberculosis germs. . . .Active antibiotic principle in common garlic has been synthesized for the first time by Sterling-Winthrop Research Institute. It has shown increased activity against organisms causing ringworm and athlete's foot. . . . Developed by Cutter Labs, a new penicillin syringe does not need to be heated before use or refrigerated after use. Special plunger permits testing for accidental puncture of blood vessels. Containing 300,000 units, the syringe is discarded after use. —PHARMACY INT'L.

GERMAN DEVELOPMENTS IN LIGHTWEIGHT CONCRETE

German processes for production of lightweight concrete have been revealed. One involves foaming of concrete with hydrogen peroxide. It can be used with any type of cement under ordinary temperature conditions, is cheaper and simpler than the oft-used aluminum-powder process.

Some lightweight German concretes are made with Iporit, using a sulphonic acid wetting agent. One is made with the Asmus process, using a foam with 10% aluminum powder and 90% calcium chloride.

A precision-built, composite concrete slab with hollow core is formed with pumice concrete and covered with a concrete coating. Twisted, pretensioned wires are used for reinforcing. Slabs are 12-20 in. wide, in varying thicknesses; lengths up to 590 ft. are made; they can be sawed. —ENGRG. NEWS-RECORD

STONELIKE PLASTIC

Having many of the physical characteristics of a stonelike material, a new inorganic plastic is resistant to 900°F., has a softening point above 2,000°F. Called Rosite, it is a form of calcium aluminosilicate with microcrystalline grain structure integrally reinforced with asbestos fiber. It is unaffected by oil, sunlight, and alkali. Compressive strength is 15,000 psi.; modulus of rupture 7,500 psi. —ELECTRICAL WORLD

MAKE PAINT STICK ON METAL

Current practice indicates that thorough cleaning and the use of a chemical wash solution, or electrochemical treatment, are prerequisites to obtaining and maintaining continuous paint film on metal products. Chemical solutions convert the surface to a nonmetallic, water-insoluble, tightly adherent coat.

Cold-wash solutions usually are made of phosphoric acid or a chromate-phosphoric acid mixture with grease solvents. Hot solutions, applied under controlled conditions in the factory, are better. They usually are made of a metallic acid phosphate and oxidizing and wetting chemical agents. —PRODUCT ENGRG.

WHAT LISTENERS PREFER

Tests by RCA Laboratories, with more than 1,000 listeners, showed a preference for full-frequency range in music and speech. In these tests, an acoustical curtain separating orchestra or speaker from audience was used to restrict frequency range.

In the case of reproduced sound, however, there appears to be a preponderant preference for restricted frequency range. Reason is that distortions involved in reproduction are less objectional with restricted range. —ELECTRONICS

PROGRESSIVE HARDENING

Comparatively long parts, such as lawn-mower blades, can be induction hardened. The work usually is fed progressively through a coil which heats a small area at a time. Then the heated portion is spray or immersion quenched. Advantages: low-power generator can be used, part is hardened with far less distortion. —AMERICAN MACHINIST

TURBULENCE THEORY PROVED

Transition from smooth to turbulent air flow over streamlined surface—important factor in drag of aircraft—has been found to be directly related to the growth of velocity oscillations in the thin boundary layer next to the surface.

Transition from laminar to turbulent flow may result from a velocity wave set up by a vibrating object in the boundary layer or by outside disturbances, such as stream turbulence and sound (propeller and engine). Surface irregularities and vibrations of surface may be factors. —AVIATION WEEK

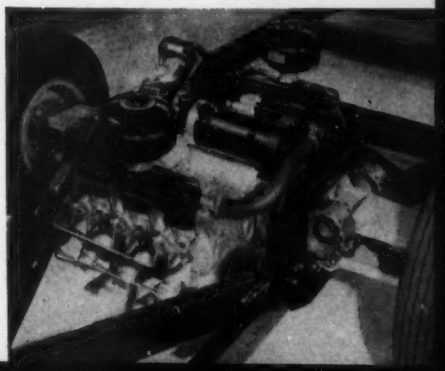
Unusual Auto

Engineered from new ideas of safety and performance—American Automobile

1 SAFETY is embodied in speed-line body which sets close to road on chassis with small wheels and low frame permitted by absence of longitudinal driveshaft. Aluminum disk brakes stop car quickly, smoothly. Sponge-rubber crash panel ahead of front seat, windshields which knock out in one piece, wide steel frame to protect body, and center headlight which turns with front wheels to light curves are other safety features. Luggage compartment is under hood, and there is space into which front-seat passengers may fall for safety. Car weighs 2,800 lb., has 128-in. wheelbase, is only 60½ in. high. Tucker Corp. expects price to be under $2,000. Two have been hand-built. Mass production operations are scheduled to begin in late 1947.

2 RACY effect is achieved even in rear-end body design of 110-mph. auto. Six exhaust pipes each serve one cylinder. Grille ventilates in-rear engine, and hinged panel gives access for servicing. Rear, as well as front, wheels are independently suspended by bonded rubber Torsilastic unit. Front wheels have balanced center-of-wheel-kingpin steering.

3 ECONOMICAL 30-35 miles per gal. is expected for large-piston, low-speed, flat-type, 150-hp., 6-cyl. (opposed) engine mounted crosswise of frame in rear. Heart of Tucker design, engine drives rear wheels independently through two hydraulic torque converters mounted on ends of crankshaft (no flywheel). Engine has fuel injection, electronic ignition, hydraulically operated valves to eliminate camshaft, bronze-lined aluminum cylinders, and oil pump connected to starter-generator for prestart lubrication. Engine can be replaced in 1 hr. for factory overhaul. Location at rear is said to eliminate 800 power-transmission parts.



VACUUM-PRESSED TABLETS

Pharmaceuticals, electrical porcelains, chemicals, sintered carbides, and vitamins are pressed into tablet form in a vacuum chamber surrounding the die table, punches, and feeding device on the new F. J. Stokes Machinery Co. tablet press. Standard punch and dies are used. Manufacturer claims: materials feed faster, elimination of entrapped air speeds press operation, thicker tablets can be made from a given depth of fill, saving in materials results through use of lower quality binders.

With ceramic powder, vacuum pressing increased output 400%. Tests are now being conducted with the press on metal powders, carbon mixes, and ceramic tile. —BUSINESS WEEK

NEW RADIATION TECHNIQUES

Infrared radiation to wavelengths as long as 30,000 Angstroms is recorded on a spectrograph developed at Northwestern University. Mirrors mounted on precision bearings disperse an infrared ray into component wavelengths and pass it through a Cashman cell. The electrical current so generated is amplified and recorded on a 10-in. graph ¼ mile long. This technique is of interest to astronomers and nuclear physicists.

Tracer techniques using radioactive isotopes are made more effective by magnetically focusing image of radiation onto a photographic plate. This gives greater resolution in locating radioactive particles. —ELECTRONICS

TIME STUDY FOR STEWARDS

To counteract growing discussion by production workers of time-study standards, American Type Founders, Inc., offered time and motion classes to union stewards and committee men. Fourteen attended the 8-week session. Held after working hours, the courses were designed to give employees an "appreciation" of the subject, not to turn out finished time and motion engineers.

Now questions involving time and motion standards arising with production workers can be answered intelligently by the union steward. Few reach grievance level. Morale among workers has improved. —FACTORY

VERSATILE PLASTIC-RUBBER

Mixtures of phenolic resin and butadiene synthetic rubber—called Conolon—are fabricated by Narmco, Inc., into panels, doors, and bulkheads for planes. Bulkheads are cellular-cellulose acetate between fibrous glass impregnated with the plastic alloy. A plastic plane fuselage has been built and delivered to Wright Field; estimates have been made on an experimental wing.

Fishing poles, golf clubs, tennis rackets, and other sporting goods will be made of Conolon. Since it can be made conductive, electrically heated blankets are planned. —BUSINESS WEEK

ELECTRONS RADIATE LIGHT

Electrons traveling at extremely high speed give off electromagnetic radiation directly. This electronic light has been observed in work on the synchrotron in the General Electric research laboratory. Discharged tangentially from the electrons, radiation is bluish-white, with maximum energy in visible or infrared portion of spectrum. —ELECTRONICS

SOYA SUCCESSES

If green soybeans are used for drying, instead of mature beans, palatibility is enhanced by a fresh-vegetable flavor. These beans should be blanched at least 8 min., often 16 min., to produce firm texture and maintain quality.

A new edible virgin oil will be produced from soybeans by Soya Corp. of America. The oil is said to have excellent keeping qualities. —FOOD INDUSTRIES

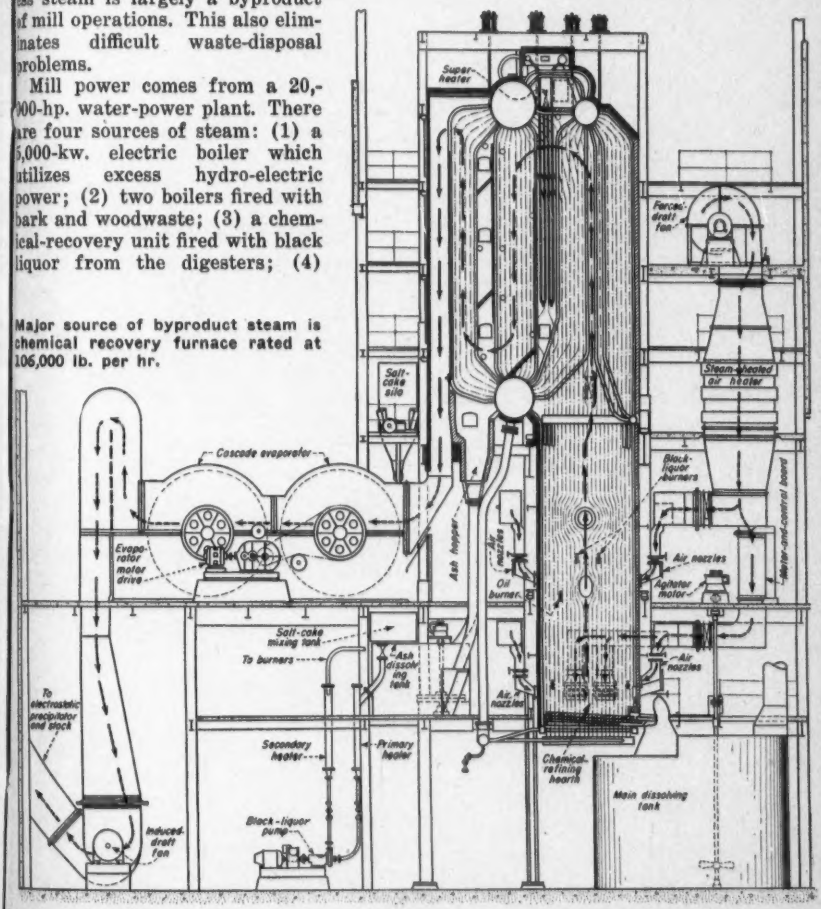
Byproduct Paper-Mill Steam

Chemical-recovery boiler major steam source. Cheap steam also comes from woodwaste boilers and electric boiler using excess hydro power

Fuel costs are reduced in the new sulphate-pulp and paper mill of Kalamazoo Vegetable Parchment Co. because process steam is largely a byproduct of mill operations. This also eliminates difficult waste-disposal problems.

Mill power comes from a 20,000-hp. water-power plant. There are four sources of steam: (1) a 5,000-kw. electric boiler which utilizes excess hydro-electric power; (2) two boilers fired with bark and woodwaste; (3) a chemical-recovery unit fired with black liquor from the digesters; (4) three coal-fired boilers. Steam from first three is a byproduct of manufacturing.

Most important steam source is 22,245-



Major source of byproduct steam is chemical recovery furnace rated at 106,000 lb. per hr.

sq. ft. chemical-recovery boiler rated at 106,000 lb. of steam per hour at 175 psi. and 450°F. total temperature. It burns 50% combustible black liquor concentrated to 60-65% solids in 5-effect evaporator by heat from stack gases. Sodium sulphate is added to replace chemicals lost from system, liquor is heated to 195°F., and pumped at 180 psi. to two steam-atomizing burners on opposite sides of furnace. These burners oscillate up and down through 30-deg. arc for wide fuel dispersement. This, with opposing fuel jets, produces a high state of turbulence and intimate fuel and air mixing for high combustion rates. Primary 300°F. air enters furnace just below burners to develop maximum heat in drying zone. Part of inert chemicals drop to bottom, remainder is carried up into boiler passes, forming slag which is removed by hand lancing. Tubes are blown continuously.

An electrostatic precipitator recovers 90% of solids which otherwise would escape from furnace.

All chemicals in recovery system are returned to bottom of furnace for refining by burning out impurities with preheated air. Molten smelt flows continuously into main dissolving tank, where it is dissolved with water to form green liquor for causticizing plant before conversion to white liquor for wood cooking in digesters. —POWER

PROTECTS RAW SUGAR

Spraying raw sugar with a solution of sodium chlorite prior to shipment inhibits fermentation and bleaches sugar slightly in a new process announced by the U. S. Bureau of Standards. Great savings in sugar will result. Before treatment, sugar is centrifuged to rid it of excess molasses.

Care must be taken in handling and storage of sodium chlorite because of possible toxic effects.—FOOD INDUSTRIES

PLASTIC BUS WINDOWS

Replacement of glass windows in trams and buses in Levis, Quebec, with Lucite acrylic resin sheets has eliminated passenger injuries from flying glass, law suits, and loss of time. Sheets are the same thickness as original glass. Plastic panes have remained unscratched and unstained after months of use under temperature conditions ranging from —45 to +120°F. —BUS TRANSPORTATION

PREFAB BRIDGE—Two 440-ft. truss spans of bridge across Hawkesbury River between Sydney and Newcastle, Australia, were prefabricated by welding, floated into position, and riveted together. Jigs held members in position for tack welding. Each welder employed qualified by making a test weld with ultimate strength of 4 tons per inch. —WELDING ENGINEER

PERMANENT MAGNETS REDUCE FIRES, DAMAGE

Installation of permanent magnets on cotton machinery not only protects machinery from damage from "tramp iron" but eliminates a frequent cause of mill fires. Burr pickers, cards, garnetts, and shredders are damaged easily by "tramp iron" passing through machinery in the presence of combustible fibers. Insurance companies report that over 78% of all opening-room fires are started by these sparks.

A series of Alnico magnet castings is mounted on alloy steel plates and surrounded by an insulating strip of form-rolled aluminum to prevent leakage of material and magnetism.

Simplest installations are plates on the bottom of a gravity chute, the number of necessary plates being determined by inclination of chute. Protection ahead of garnetts is provided by two-section, compact magnetic separators over top of spiked apron of feeder. Here material is well opened, is traveling slowly, and passes through a concentrated field. Plates placed on picking tables ahead of choppers or shredders are extremely effective. —TEXTILE WORLD

"INSTANT" RICE DEVELOPED

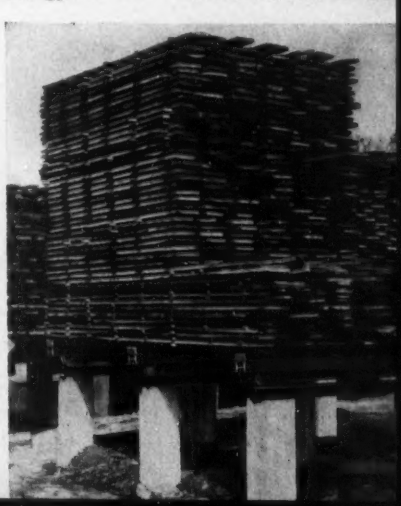
Fluffy vitamin-rich precooked rice which can be prepared for the table in 10 min., compared to 40 min. for ordinary rice, has been developed by General Foods Corp. Rice is cleaned, soaked, cooked, washed, drained, and dried. New high-temperature fast drying is used to case-harden grain and limit shrinkage; as inside of grain shrinks it pulls to hardened outside wall. Standard Proctor and Schwartz air-blast dryer was modified by changing fans and heaters.

When fortified, the "instant" rice contains complete initial vitamin content. Vitamin loss is reduced by not using excess water in process. Prepared rice dishes and puddings using the new rice have been developed. —FOOD INDUSTRIES

PRECIPITATOR ELIMINATES OIL MIST, CUTS COST

Oil mist created by automatic screw machines is precipitated by an electrostatic air cleaner at Wolverine Brass Works. Working conditions are improved, plant cleaning reduced, and cooling oil recovered. Savings will pay for the installation in 1 yr. Air ducts carry mist from machine hoods to precipitator.

In 8-hr. shift, 3 gal. of oil is recovered. At least 150% more oil than this formerly was thrown into room and lost. Hood now saves major portion of this to make total saving 7½ gal. Installation cost $372.60 per screw machine for electrical equipment, $175 for cage and ducts. Power pack serving four precipitators consumes 90 watts of electrical energy. —AMERICAN MACHINIST



CHEAP LUMBER HANDLING — Bunkers, power-transfer units, and trackage for new materials-handling system cost Grand Rapids Chair Co. $9,000. It saved over $10,000 the first year and increased storage space 200%. Now only two mechanical handlings are necessary. Tracks from kiln to sawing room end on a hydraulic lift, which carries lumber to cutter's bench. —FACTORY

TELEVISION BY PHONE

Phone Vision, a method of charging a fee for a particular television program, has been devised by Zenith Radio Corp. A vital portion of the picture signal is sent over a telephone or electric power line to user. Subscriber calls telephone operator when he desires to see a special program, and receives it by means of an attachment to telephone. —ELECTRONICS

LIGHTPLANE OF TOMORROW

The high-performance, all-weather, quiet lightplane of tomorrow will include the following design details, according to a survey of the industry: Two-control operation with spin-proof and stall-resistant characteristics; multiblade, fan-type propellers, to reduce noise; smooth wing and fuselage with maximum air tightness; fuel-injection engine with protected air intake, thermostatically controlled "hot spot," and air cleaner; slightly tapered wing with washout twist, well-cambered thick section with camber increasing toward tip; spoilers replacing ailerons for lateral control; and V-tail giving necessary stability and control with less area. —AVIATION WEEK

APTITUDE BY ELECTRONICS

Ability of worker to handle a sewing machine is tested by an electronic aptitude tester developed by National Physical Laboratory, Union of South Africa. A wavy line on a motor-driven chart is moved at speed controlled by subject with a foot pedal. Subject endeavors to keep a phototube (mounted on a horizontal slide) in "contact" with line, and a clock records intervals of time when phototube is off line. —ELECTRONICS

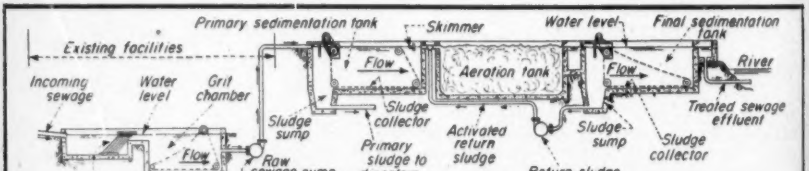
ADOPTS MODIFIED AERATION FOR SEWAGE TREATMENT

Modified-aeration process, with air supplied at rate of 0.4 cu. ft. per gal. of sewage, will be used in a 200-mgd. sewage-disposal plant being rebuilt in Philadelphia, Pa.

Material is to be preheated to 110°F., charging digesters every 2 hr. Sludge from primary settling tanks will be removed by longitudinal and horizontal scrapers, sludge being piped to sludge storage tanks. The four aeration tanks will be divided into four channels, equipped with effluent and influent devices at each end. Air supply points will be located in Y-shaped partitions at quarter points in the channels.

The four final settling tanks, transversely divided into 16 channels, will have three effluent troughs—one on each side of the channel from a point 30 ft. beyond inlet to outlet and a third one transversely connecting side collectors 30 ft. from outlet.

Air will be supplied by a centrifugal and three positive-displacement blowers, with a total capacity of 49,000 cfm. Extreme fineness of diffuser tube pores necessitates use of two electrostatic air filters. —ENGRG. NEWS-RECORD



Flow sheet of Philadelphia sewage-treatment plant.

Loader tonnage is up 42%, man-shift tonnage up 80%, with trackless equipment.

Mining Methods That Pay

Trackless mining increases coal production 42%. Vent pipes release gas. Compressed-air on-shift blasting utilized in progressive Illinois mine

Increased productivity per miner, achieved through use of modern equipment, is helping to pay for increased safety at Franklin County Coal Corp. Trackless mining, ventilating of gas from old workings, and air-breaking of coal are new mining principles being employed by the operators.

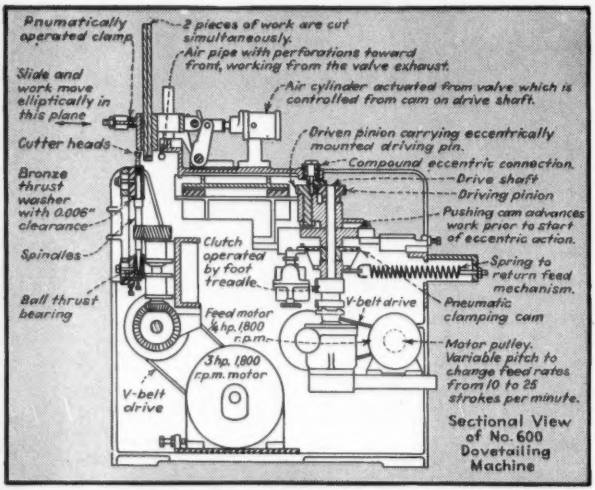
Trackless Mining—Although conversion to trackless mining is not complete, initial trials showed machine production increase of 42%. Per man-shift tonnage was up 80% over tonnage of the same crew in track areas. Necessary crew has been decreased from 21-24 men to 15-17.

Future trackless mining plan will consist of a 36-room panel with three transfer stations, panel being worked in 12-room sections. The 24-ft.-wide rooms will be driven 300 ft. deep, and crosscuts on a 60-deg. angle will connect rooms. Recovery will be 60% against 52% in track areas. In test area, about 7½ ft. of coal is removed, leaving 18 in. of top coal in place. When bad roof conditions are met, room is stopped and faulty section timbered with solid cribbing. Then room is reopened from the back through next room, and a cut-through restores regular air movement.

A Sullivan 10-RU rubber-tired cutter, with 9-ft. bar and regular bits, cuts face above blue band. Middle cutting of face permits coal to fall clear of cut, providing well-dusted coal. Motor-driven pneumatic-tired drill carriage, fabricated in the mine shops, carries two drill posts.

Gas Released—To improve mine ventilation, air courses built of wood were replaced with concrete-block walls. Drill holes were bored from surface into old areas, releasing gas and reducing pressure against seal. Holes have 6-in. dia. and carry a 4-in. pipe enclosed in concrete. Pipe extends 20 ft. above ground, with top 3 ft. perforated with ¼-in. holes. Top is capped. Methane gas has been reduced 70% through installation of pipes; operators hope to get readings down to 0.25%.

Compressed-air Shooting—The third innovation at Franklin is the on-shift shooting with compressed air. This "Airdox" system employs air between 9,500-10,000 lb. Eight-cylinder, 6-stage


Pneumatically operated clamp
2 pieces of work are cut simultaneously.
Air pipe with perforations toward front, working from the valve exhaust.
Slide and work move elliptically in this plane
Air cylinder actuated from valve which is controlled from cam on drive shaft.
Cutter heads
Driven pinion carrying eccentrically mounted driving pin.
Compound eccentric connection.
Bronze thrust washer with 0.006" clearance
Drive shaft
Driving pinion
Pushing cam advances work prior to start of eccentric action.
Spindles
Clutch operated by foot treadle
Spring to return feed mechanism.
Ball thrust bearing
Feed motor ¼ hp. 1800 r.p.m.
V-belt drive
Pneumatic clamping cam
Motor pulley. Variable pitch to change feed rates from 10 to 25 strokes per minute.
3 hp. 1800 r.p.m. motor
V-belt drive
Sectional View of No. 600 Dovetailing Machine

AUTOMATIC DOVETAILER — Rounded type dovetailing of wood pieces for furniture drawers is done automatically by two new Wysong & Miles Co. machines. Model 600 handles drawer sides; 601, fronts and backs. Each machine has separately powered multiple (15) cutting spindle head, and workpiece is moved against cutters in front-to-rear slide. Two drawer sides are clamped back to back, and advanced through cutters in slightly elliptical path by eccentric drive. Drawing shows details of No. 600 machine. —PRODUCT ENGRG.

compressors, located on the surface 3 miles from main shaft, compress air to 10,800 lb., the air being piped to area in thick-walled, seamless tubing. Operation procedure is:

(1) Undercut face; (2) drill face with 4-in. bit, 8 holes for headings, 10 holes for rooms; and (3) break coal down by Airdox tube, working up the face from bottom.

One man operates Airdox equipment on each shift, control equipment remaining at least one crosscut back of face being broken. The ½-in. dia. air tube is inserted to back of hole at bottom of face and then withdrawn 5-6 in. Tube is not wedged or tamped. It is charged, then operator turns valve to atmosphere to release the pressure. Pressure drop causes ball bearing-type valve in tube to open and release air from tube at back of hole. Air at approximately 950 atmospheres expands and breaks down coal.

Tube can be withdrawn through broken coal without excessive damage, the valve being usable several thousand times. —COAL AGE

RADIO CUTS LINE COSTS

Two-way radio communication between widely separated cable-stringing crews and equipment on Pacific Gas & Electric Co. high-tension transmission line gets work done in half the time with fewer men. Under radioed directions from foreman at an observing point along line, it is possible to pull cable by truck instead of using 12 linemen for this purpose. Three linemen still observe cable sag.

Two-way radios are in truck and foreman's car. —CONSTRUCTION METHODS

PREFAB TRUCK BODIES

Prefabricated truck bodies, in 12-, 14-, and 16-ft. lengths, can be assembled by dealers in 10 operations in 10 man-hours. Units arrive from factory with primer coat, ready for finish paint job. To assemble, foundation strips are first laid and steel-ribbed floor unit installed. Then side panels, with or without doors, are placed. Rear panel is placed, then welded. Units are produced by Fruehauf Trailer Co. —BUSINESS WEEK

CONTINUOUS STEAMER PEELS, BLANCHES, COOKS

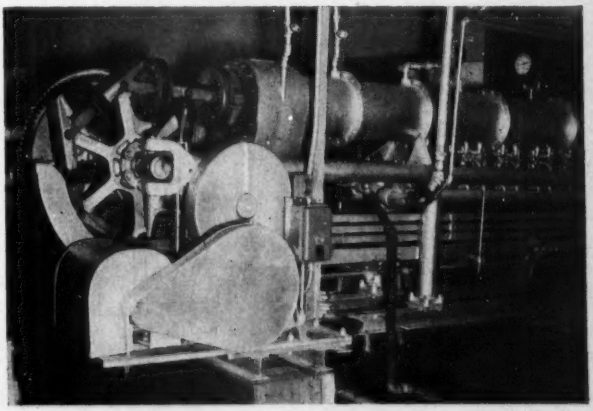
After 4 yr. of development, a continuous steamer which cooks products such as fish or blanches, peels, or cooks fruits and vegetables is being built by Cleaver-Brooks Co. Essentially, it is a 24-ft. steel tube of 12-in. dia. through which a series of gasketed pistons are drawn in the manner of an endless chain. The 8-cu. ft. spaces between pistons function as processing chambers under 1 to 100-psi. controlled steam pressure. Tube is in 9 sections, five fitted with steam inlets, each with pressure controls. Pressure is reduced near discharge end.

Capacity is 5-7 tons per hr. in blanching; 7½-10 tons in peeling; 2 tons per hr. in cooking salmon. Unit permits continuous operation although materials are handled in small batches. Exposure to quality deteriorating conditions is negligible. During passage through tube, each portion of material is turned or tumbled and subjected to same steam pressure for same time without formation of aggregates or packing. Continuous operation permits (1) positive time-temperature control; (2) labor saving; (3) reduction in loss of nutritive values resulting from exposure to light, atmospheric oxygen, and air-borne contaminants; (4) less enzymic change between preparation and heat treatment; (5) economy of steam, hot water, and equipment. Unit requires but 25x2½ ft. of floor space and is only 5 ft. high.

Peeling by this method involves only 9-11% loss for potatoes; 8% for carrots; 11% for beets; 10% for sweet potatoes. Hand trimming and eye or scab removal are eliminated. In case of grapefruit, heat treatment is followed by manual slipping of skin off fruit. Coconuts require cracking and removal of shell as with boiled eggs. Separation and removal of skins of root vegetables, onions, and apples are accomplished during passage through a rotary spray washer.

As products discharge to the atmosphere, internal pressure disrupts the skin, peel, or other surface tissues to make removal easy. Sudden reduction in pressure results in sufficient evaporation of surface and near-surface moisture to give almost instant cooling and stoppage of incipient cooking effect.

Steam loss in 10-hr. day, in terms of boiler water, is 800 gal. A 40-hp. boiler provides steam. —FOOD INDUSTRIES



Continuous peeler, blancher, and cooker consists of endless chain of pistons moving through steam tube.

TELEVISION BANKING

Quick identification of check signatures is achieved at a Long Island bank by television between teller's window and bookkeeping department. This saves the depositor's time and probably doesn't cost too much. —ELECTRONICS

Foreman—Key to Safety

Entire safety program at Proctor & Gamble Co. plants hinges on the foreman. New employees are taught safety from employment office on

The enviable safety record established by Proctor & Gamble Co. plants is hinged on shop foremen. Workers are introduced to safety by the employment office; from then on the employee becomes a part of the overall program. The entire safety program thus is made easier when new employees begin their jobs convinced that the safe way is the only way to do the job.

When a prospective employee arrives at the personnel department, the company safety policies are explained to him. The employee is given a cartoon-illustrated booklet on safety, listing general safety rules, details of proper clothing and safety equipment, precautions for use of tools and equipment, and fire precaution measures. The department foreman then takes the new employee through his section, explaining fire extinguishers and evacuation alarms. Now ready for work, he is given his personal safety equipment, the foreman explaining the use of each piece of equipment.

A short visit is made to the plant hospital to familiarize the employee with the available medical facilities, and the nurse explains the importance of reporting immediately for any type of treatment no matter how slight.

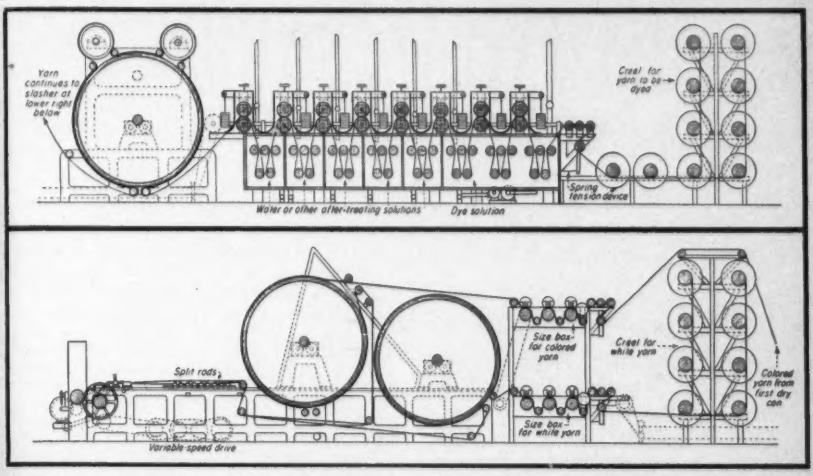
A regular rating form is kept of each worker's safe working habits, and a file card is kept. After employee has been on the job for a few days, the plant safety engineer visits him to follow up on the foreman's report.

Special studies on safety are conducted in all of the plants by the safety department, covering processes and equipment still in development stage. Recently a film based on a survey of ladder accidents was shown to employees, and amount of time lost due to ladder accidents was reduced 98.7%.

Each month, plant superintendents meet with supervisory personnel to present special problems of safety. After these meetings, the foreman meets with his section to discuss unsafe practices and recent injuries. Complete details of all accident, no matter how minor, must be reported immediately, each plant supervisor receiving a monthly summary of plant hazards. If reports are not complete, accident prevention program will be handicapped.

The Macon plant of Proctor & Gamble has just completed its seventh year and 1,000,000 man hours without a production accident. —FACTORY

MECHANIZED FOUNDRY—To improve output and quality, Westinghouse Electric Corp. installed giant "sand slingers" in its foundry. Operator fills molds from overhead sand bins and rams the sand at rate of 1,000 lb. per minute. —BUSINESS WEEK


Yarn continues to slasher or lower right below
Creel for yarn to be dyed
Spring tension device
Water or other after-treating solutions
Dye solution
Split rods
Size box for colored yarn
Creel for white yarn
Colored yarn from first dry can
Size box for white yarn
Variable-speed drive

DYES, SIZES, BEAMS COTTON—Cotton yarns are dyed, sized, and beamed in continuous process in new United Steel of America, Inc., machine. Prototype has operated 7 yr. Starting from section beam creel, yarn is immersed three times in direct or sulphur dye solution, then washed and passed through after-treating tanks. Vat dyes can be used. Yarn then passes over drying cylinder and to a three-immersion-roll size box, over drying cylinder, through split rods, and onto loom beam. Manufacturer claims 2,700 ends of 9s yarn can be processed at 25-30 yd. per min. Power-driven nips and immersion rolls prevent stretching and breaking. Unit requires 90x10-ft. area. —TEXTILE WORLD

NEW OIL-WELL PUMP SAVES 25-30% IN COSTS

Requiring no elaborate superstructure, the new Kobe, Inc., petroleum pump promises savings in pumping costs between 25 and 30%. It should permit operation of low-yield wells, now often shut down.

Standard fixed pumps are suspended by a string of steel rods as long as the well is deep. The Kobe "free" pump, however, is not suspended in any manner. Pumping system includes a pair of parallel tubes inside the well casing, joined at the bottom by a U-connection. Legs of the U-tube are filled with crude oil from stock. Pump, in a machined case of 2 in. dia., 10 ft. long, is inserted in pipe and forced to bottom by oil under pressure. Pump seats itself; oil pressure starts it pumping. To return pump to surface, operator reverses oil pressure in tubes.

Breakdowns in fixed standard pumping equipment take 4 men 8 hr. to repair. The manufacturer claims the "free" pump can be put back into operation in 95 min. —BUSINESS WEEK

TREND TO CARBIDE DIES

Carbide metal stamping dies now are being ordered by major companies. Higher cost is good investment, considering extra millions of hits and freedom from downtime. Die designers no longer shy away from using carbide members in compound dies. Massive carbide pieces now can be preformed; methods for attachment without causing internal strains have been worked out by die manufacturers. — AMERICAN MACHINIST

TECHNICAL SHORTS

Degassed Iron for Vacuum Tubes—Pure degassed iron effectively can replace scarce molybdenum and nickel in the construction of electrodes, getters, and other metal parts of electron tubes. Production of it is tedious and costly. —ELECTRICAL WORLD

Vacuum Package—To keep sliced bacon fresh, Armour & Co. has developed a method of vacuum-packing the meat in a flexible transparent wrapper. —FOOD INDUSTRIES

Eliminates Stair Accidents—Mirrors opposite stairways have entirely eliminated stairway accidents in 6 months they have been installed at House of Lance. Personal pride in appearance apparently slows workers as they see themselves ahead. —FACTORY

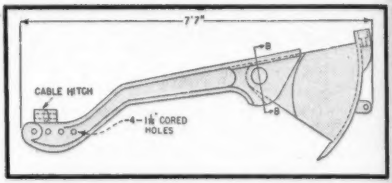
Repel Mold, Mildew—Tests by the U. S. Dept. of Commerce to find the most effective chemicals to combat mold and mildew in textiles proved copper 8-hydroxy quinoline, pyridyl mercuric stearate and chloride, copper naphthenate, and copper ammonium fluoride most effective. Tests were conducted with 15,000 samples in Canal Zone. —PHARMACY INT'L.

Air Tamper for Steep Banks—To compact backfill in over-excavated rock cuts specified for Friant-Kern Canal, a pneumatic tamper was designed. It is a skid-mounted machine with movable boom along which travels an air-powered ram that delivers 10,000 lb. blows on sideslopes.—CONSTRUCTION METHODS

Magnetic False Teeth—A dentist is placing four tiny "Alnico" magnets with poles opposed in dentures, so that the dentures are constantly held in place in the mouth by slight pressure. —ELECTRICAL WEST

Little Shapers Handy—Bench shapers are handy, even for operations other than shaping. Telechron, Inc., has adapted 6-in. stroke bench shapers to broaching and knurling production operations. Application of air cylinders, chucks, cam-actuated movement, and careful setting of shaper stroke speed has increased production 500%. —AMERICAN MACHINIST

Toward Better Understanding — Before Lynchburg Foundry Co. instituted its work-simplification program, classes were held for all management men from president to foreman. After management men understood principles of program, classes were opened to production workers. As a result, program has complete support of all. —FACTORY



KNEE-ACTION SCRAPER—Wear of blades and teeth is materially reduced by hinged construction of scraper designed for slusher drifts by Howe Sound Co. Because the blade mounting is hinged, it "turns under" on the back-haul and slides along on heavy wear ribs instead of on the edge of the blade or tooth. It has given good service in normal drifts. —ENGRG. & MINING JOURNAL

Saturated Brine Cuts Costs — Using self-filtered, saturated pure brine, made from inexpensive rock salt in a storage Lixator, Dan River Mills has cut annual salt bill, saved time and labor, and eliminated uneven dyeing caused by inaccurate salt solution. Cost of installation was saved in the first year of operation. Lixator holds 18 carloads of rock salt, dumped in directly from car. Salt flows from hopper into tank, dissolving at rate of 10.6 tons per hr. —TEXTILE WORLD

For Sightless Passengers—To insure that trolley buses stop at corners for sightless passengers, Indiana Service Corp. has supplied sightless riders in Fort Wayne with special books. Pages have perforated numbers indicating routes. Sightless passenger holds up page with desired number showing, and the proper trolley stops. —BUS TRANSPORTATION

New Uses of Shot Peening—Shot peening can be used to inhibit stress corrosion cracking in metal, to reduce porosity in parts subjected to pneumatic or hydraulic pressures, to test adherence of silver plate, to improve lubricating properties of plain bearings, and to replace polishing operations in metalworking plants. —PRODUCT ENGRG.

Better Peach Color—Discoloration of canned freestone peaches can be reduced greatly by steaming them longer before removing the skins. Sealing cans with a minimum amount of oxygen also reduces discoloration, makes sirup clearer. —FOOD INDUSTRIES

Chemical Refrigeration—A freight car has been refrigerated experimentally with a split-absorption system charged with liquid anhydrous ammonia. The system has no moving parts nor power requirements. With 92°F.. outside temperature, frozen food inside car was kept at 0°F. in a 10-day stationary test. Ammonia consumption was 41.98 lb. per hr.; about 5,000 gal. of water was supplied during test. Results were satisfactory. —FOOD INDUSTRIES

Displays Sell Machines—Using a 15x18-ft. space, previously wasted, to display equipment nets Lorenz Co. $6,000 monthly in added sales. Special forms are used to list sales consummated in the display area. Machinery is operable. —MILL SUPPLIES

"Lubricated" Concrete—Concrete for large hoist and motor-generator installation underground at a mine in Idaho was "lubricated" for easier pumping by addition of diatomaceous earth. This also increased workability of concrete. —ENGRG. & MINING JOURNAL

Welding Store on Wheels—Stocked with a $4,000 inventory of welder's supplies, a truck is used effectively by Bakersfield Machine Co. in selling to oil fields, farmers, factories, and welding shops. —WELDING ENGRG.

Better Without Springs—By removing springs from the rear axle of a 30-ton trailer, Binkley Mining Co. has cut maintenance without imparing serviceability. —COAL AGE

Remote Solution Batching—Eastman Kodak Co. engineers mix 1,000 gal. batches of photographic solutions by romote control through a control panel a floor above production area. One board controls developer, another fixer solution. By turning valves on board, engineers accurately control mixtures. More uniform recipe and faster production result. —BUSINESS WEEK

New Brake-lining Process—Goodyear Tire & Rubber Co. cements brake linings to shoes, eliminating rivets. More braking surface is thus provided; scoring of brake lining eliminated. —BUS TRANSPORTATION

Vegetable Heat-Pump—Both ends of the refrigeration cycle are used by a firm in Phoenix. Heat taken from vegetable cold storage rooms is pumped over into the banana ripening locker. —ELECTRICAL WEST

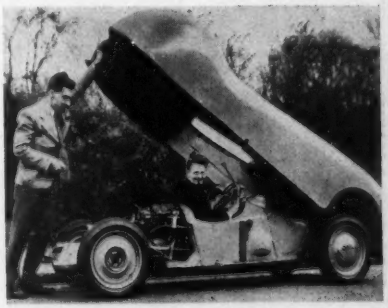
Multicolor Metal—Anodizing and dyeing are combined to produce almost any desired color, grain, or other effect on aluminum and some alloys. Altones, Ltd., Glasgow, introduced the technique. —PRODUCT ENGRG.

Silicone Mold "Grease"—Molders of plastic and rubber goods spray, brush, or dip a silicone glaze onto molds to prevent sticking. Short air dry, followed by baking at 450° F. for 1 hr., hardens film. Coating can be removed in 15-min. by boiling in 2% trisodium phosphate. Glaze also is used on ovens, hot-air ducts, and stacks. A silicone mold-release emulsion is used to form a parting surface between the metal dies or molds and workpieces of plastics or of synthetic rubber. —AMERICAN MACHINIST

Quick Work-order Drawings—Field inspection sketches and office drawings of work layouts are reduced to a minimum at San Antonio City Public Service Board. Work-order drawings for new services and line rebuilds are made directly on photostat copies of office record maps. Corrections are later made on the office records from correction notes on the photostats. A heading laid over map section when photostating accommodates order and material information. —ELECTRICAL WORLD

Prevents Shady Filling—A loop of 1/32-in. wire inserted into a hole drilled in back cap bar directly behind left-hand end of top-roll cot decreases shady mock-twist filling and decreases creeling work. Loop end is turned toward roving and feeding top creel board; loop is about 1 in. above back cap board. —TEXTILE WORLD

Wide-open Nacelles—Nacelles on Consolidated-Vultee's twin-engine transports peel back like an orange to give complete access to engine. —AVIATION WEEK



LIGHTWEIGHT BODY — This one-piece aluminum body, pivoting at front, gives easy access to engine. The British-made Cooper Special is powered by a 5-hp. twin-cylinder engine. Top speed is 70 mph.; gasoline consumption, 65 miles per gal. Car may sell for $1,000. —AMERICAN AUTOMOBILE

Progress in Printing Dyes

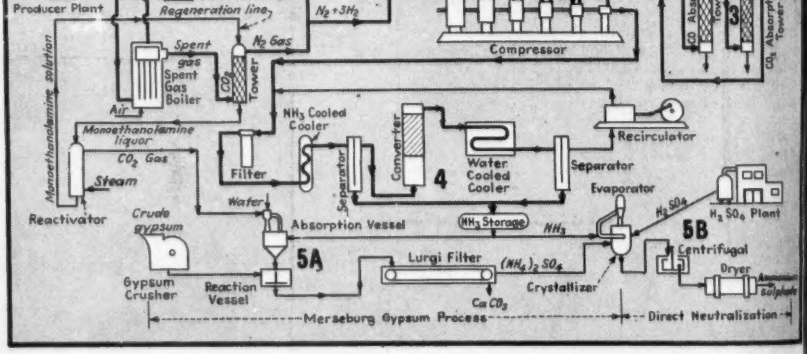
Textile printers forced to watch dyes by color-conscious buyers. Preparation of cloth, printing thickeners, and colors must be controlled closely

Color-consciousness of customers has forced textile printers and dyers to the use of fast colors, thus the use of vat and azoic colors has increased. Fugitive basic, acid, and direct colors now are used for novelty work where brightness of shade is of major importance.

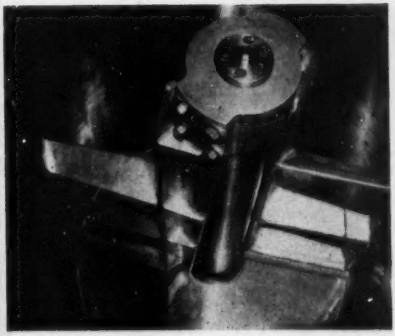
In proper application of either vat or azoic colors, preparation of cloth, printing thickeners, and colors, and close attention to applications are all important. Cloth is prepared similarly to cloth for dyeing. It must be boiled-out or bleached to remove all oils, sizing, and natural impurities. Cloth should be boiled with alkali in kiers and treated with acids. Between operations cloth is washed.

Function of the printing gums and thickeners is twofold—to serve as carriers for color and to allow dyeing conditions to be produced in printed portions and prevent flushing of color to unprinted portions of cloth. They must be cheap, have film-forming characteristics, and be elastic when dry so they will not dust. Aqueous solutions must be resistant to acids and alkalis. On steaming they should absorb moisture and form a minute dyebath in heated atmosphere.

Three types of thickeners are used—starch, British gum, and prepared textile gums. For special work, tragacanth and gum senegal are used. The former is easily removed by washing but is ex-



UNIQUE CHEMICAL PLANT—Designed to utilize natural resources in India, the new $7½ million ammonium sulphate plant of Fertilizers & Chemicals, Ltd., has unusual engineering features. Hardwood instead of coal generates the producer gas with which to make hydrogen and nitrogen for ammonia production. Secondly, Merseburg gypsum process is, for first time, combined with direct neutralization to make ammonium sulphate. Reasons are instability of gypsum supply, local need for sulphuric acid, and plant flexibility. Process is shown in flow sheet for plant, which has capacity of 150 tons of ammonium sulphate a day. Main steps are gas production and purification, ammonia synthesis, and ammonium sulphate production. —CHEMICAL ENGRG.



SANITARY DESIGN—Suitable for wide use, sanitary chocolate kettle is made of stainless steel and has polished cast-aluminum agitator and stainless steel scraper blades. Sharp corners are replaced by long-radius curves. Vertical tube, integral with bottom, encloses shaft and bearings. There are no stuffing boxes or glands. Agitator lifts out after one nut is removed, and scraper blades slide from slots for cleaning. Stainless steel drain valve is disassembled by removing one nut. Sectional removable cover has no seams, beads, or hinges to collect dirt. Kettle housing has smooth white finish. —FOOD INDUSTRIES

pensive and yields poor strength; the latter gives sharp prints but of poor color value.

Azoics are divided into two groups—base and stabilizing diazo salts and the "diagen" and "rapidogen" colors, which are mixtures of stabilized diazo-imino compounds and coupling components. They are prepared for printing by diazotizing with an excess of sodium nitrite and hydrochloric acid. Then solution is buffered by addition of sodium acetate. Reaction is carried out at 5°C. and kept cool at all times. Thickener is added and resulting paste is printed onto cloth. Diazo salt solution is prepared by mixing salt and warm water, then adding cold water and necessary volume of thickener.

Balance between naphtol coupling component on goods and the concentration of diazo compound in printing paste must be checked closely. An excess of diazo compound may result in a tarry, phenolic body, producing dull shades and stain on unprinted portion of cloth.

Diagen and rapidogen paste is applied to white goods and color develops as dried print passes through a steam atmosphere charged with acetic and formic acid. An alternative method passes dried, printed goods through a hot acid bath saturated with common salt.

Vat colors are outstanding for fastness to light, water, acids, alkalis, and bleaching. In shirting and drapery material, vat dies produce the highest quality work. The soluble vats are sulphuric acid esters of leuco or reduced forms of color. After printing with oxidizing agents and drying, prints are acid-aged to convert the vat color to the oxidized form within fabrics.

Vat colors are characterized by their ability to form soluble leuco derivatives, possessing an affinity for cellulosic fibers. They are used usually with British gum. After drying, material is aged in neutral steam at 215-220°F. for 5 min. After aging, goods is oxidized with sodium dichromate and acetic acid, then washed to remove thickener and unfixed dye. —TEXTILE WORLD

HIGHLY USEFUL PLASTICS

Capable of being molded in a wide range of colors, urea and melamine resins form thermosetting plastics that are tough, hard, and water-resistant. Pure urea-formaldehyde resins are colorless. Fillers, usually alpha cellulose pulp, are incorporated to improve water resistance and prevent cracking and crazing. Resulting translucent compound can be given unlimited range of colors by adding pigments.

Higher in cost, melamine-formaldehyde has superior resistance to high temperatures, compatibility with mineral fillers, and increased resistance to water.

Applications of these resins also include laminates, adhesives, coatings, and insulation. —PRODUCT ENGRG.

15 RAILROAD AXLES AN HR. MACHINED ON AUTOMATICS

Railroad-car axles are machined at a rate of 15-20 per hr. with a series of three new tools equipped with automatic power work-transfer mechanisms and connected by conveyors.

First machine is a two-station double-end type which holds axle stationary while tools rotate. At No. 1 station, a short rigid tool in each head removes scale, then parting tools cut groove in crop and automatic shears remove crop. At station No. 2, both ends are centered in conventional fashion.

Second machine supports axle between centers, rotating it by friction pads for rough turning. It is a single-station, double-end, automatic lathe.

Third machine puts a smooth face on ends of the axle with a single-point carbide tool at each end. Part is held stationary while rotating tools feed across work. Finished axle is ejected onto conveyor, where it is crated for shipment.

This Transfer-matic line of Cross Co. will handle forgings of 3¾-10½-in. dia., 5-9 ft. long. —AMERICAN MACHINIST

NEW NYLON DYE

A new nylon dye for full-fashioned hosiery, developed by Specialty Products Co., and a dyeing process, formulated by Waldension Hosiery Mills, produce a deeper dye penetration, and color is not faded by frequent washings. The new dye contains no skin irritants.

Dyestuffs are selected and weighed according to desired shade, proportion of dyestuff to scouring being 1:2. To this, 10% caustic acid is added, figured on dyestuff weight. Paste should stand for a few minutes to insure proper solution. Two parts of water are added to one part of paste, and the solution is agitated. Solution must be strained before it is placed in dye tubs.

In dye tub, 4-12½% Pro-Nyl scour is added, depending on pretreatment of nylon. Hose are entered and left in 190°F. solution for 30 min. Tub is then drained and refilled and dyestuff introduced. This is kept at 190°F. After 30 min., 4% bicarbonate of soda is added and machine is run for 20 min. at 180°F. Hose are finished in cold water. —TEXTILE WORLD

PULSE CODE MODULATION DEVELOPED BY BELL LABS

Freedom from noise and interference in long-distance microwave radio relay communication systems is obtained by the new pulse code modulation developed at Bell Telephone Labs. The continuous voice signal is sampled for about a millionth of a sec., 8,000 times a sec., giving an upper frequency limit between 3,000 and 4,000 cps. The instantaneous amplitude of the signal, as determined by the momentary sampling, is converted into one of 32 five-pulse code groups. The code groups constitute the pulse subcarrier with which the microwave radio carrier is modulated. At the relay stations, the code groups can be regenerated despite considerable interference. At the receiver they are reconverted into the voice signal. Loss in fidelity is negligible.

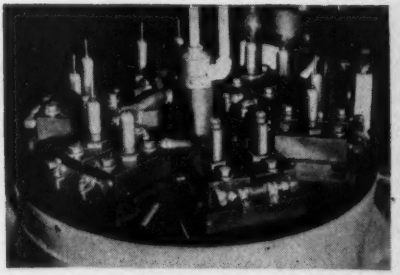
The pcm. system using five-pulse groups requires slightly less than five times the bandwidth of a pulse amplitude modulation system, but it is far less subject to cross-talk in a multiplex network and tolerates much lower signal-noise ratio. —ELECTRONICS

LIMESTONE NEUTRALIZER

Upflow beds of limestone, combined with a spray-type aeration system, have proved effective in neutralizing acid-reacting effluent from acid dipping and plating operations in General Electric's Philadelphia Works. System reduces cost and maintenance, eliminates need for expensive acid pumps, effectively prepares effluent for discharge into city sewers. —CHEMICAL ENGRG.

FAST FINISHING—Rotary, straight-through, and reciprocating fixtures multiply capacity of disk grinders. End trunions on universal-joint spiders are being ground to 0.001 in. tolerance. Drum holds parts in clamps, is rotated 2-3 rpm. —AMERICAN MACHINIST

Quick Work



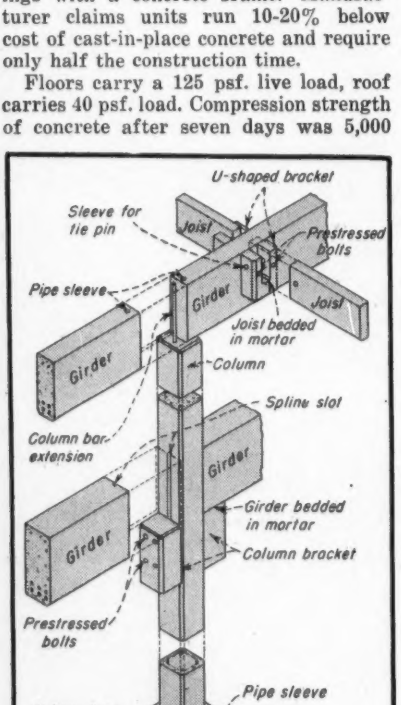
QUICK DDT BOMBS—Special six-station fixtures index automatically for rapid projection welding of DDT bombs. Two stem-and-bulb assemblies are welded at a time in this machine, which is conveniently loaded as it rotates. —WELDING ENGINEER

,700 PINS PER HR.—Six centerless grinders nd three centerless appers in this line finish 1,700 to 2,600 piston pins per hr. to a ylindrical surface accuracy of 1½-2 microinches. Pins are delivered to line after heat-treating and shot-blasting and are packaged for warehouse at other end of line. Three machine operators and a packer keep line going at Nylen Products Co. Break in line between grinders and appers permits checking. —AMERICAN MACHINIST

PRECAST CONCRETE FRAME FOR 2-STORY BUILDING

Selected from a prefabricator's handbook, a 2-story, precast concrete frame building, 110x120 ft., was recently constructed in Pittsburgh. Concrete frames are not new in the construction industry, but this is one of the first 2-story buildings with a concrete frame. Manufacturer claims units run 10-20% below cost of cast-in-place concrete and require only half the construction time.

Floors carry a 125 psf. live load, roof carries 40 psf. load. Compression strength of concrete after seven days was 5,000 psi., using Type III high-early cement; working stress was 2,250 psi. Floor members are simply supported spans.



Isometric view of column shows girder and joist connections.

Precast columns are 12x12 in. x 27½ ft. long; base is 12 in. thick, 6-in. wider than column. Pipe sleeves in each corner carry 1-in. round anchoring bolts from foundation. Precast concrete brackets, on opposite faces of column form, girder seats. Prestressed bolts hold brackets to columns. Floor girders are 12x24 in. x 27 ft. 11½ in., each girder supporting three 8x12-in. joists. Roof girders are seated directly on column top and are tied by dowels.

Roof slabs are 12 in. wide, 5 ft. long, with a 1½-in. deck spanning 3-in. deep longitudinal ribs. Second floor has similar dimensions but is more heavily reinforced. —ENGRG. NEWS-RECORD

MAN-MADE RAIN

Australian weatherman recently produced an all-afternoon rainfall covering a 20-mile area by dropping 100-lb. of dry ice pellets. —SCIENCE ILLUSTRATED

Thousands of tons of water poured into the Roosevelt Dam watershed in eastern Arizona recently after a man-made rain. Pellets of dry ice were dropped into rain-saturated clouds. Water is used for power generation and irrigation. It was the first experiment with man-made rain in the United States since General Electric engineers discovered the principle last winter. —ENGRG. NEWS-RECORD

PRESSURE RELIEVES STRESS

There is a striking correlation between changes produced in physical properties of materials by a decrease in temperature and an increase in pressure. Transmission of a compression wave of large magnitude through steel castings often will accomplish considerable internal stress relief, as does temperature cycling. Some foundries vibrate castings or subject them to severe shocks to partially relieve stresses. —PRODUCT ENGRG.

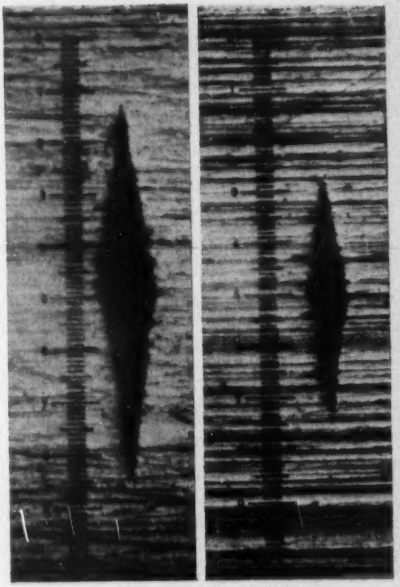
POWER PLANT PROGRESS REPORTED AT MEETING

Recent developments in power-plant practice were reported at a recent meeting of American Society of Mechanical Engineers. A gas-turbine cycle for use with high-moisture waste fuels is proposed. Turbine exhaust serves as preheated air for a waste-fuel furnace. Products of combustion give up heat to gas-turbine cycle in a heat exchanger, and a separate combustor is provided in event sufficient waste fuel is not available to produce the desired turbine throttle temperature. The cycle is considered particularly adaptable for producing power from incinerators.

Tests of boiler drums placed in service in 1901 and 1902 revealed no sign of deterioration or any general corrosion. Careful and regular maintenance undoubtedly contributed much to this good experience. Conclusion is that derating of drums operating under these particular conditions is not warranted.

Use as power-plant fuel of char produced by low-temperature carbonization of bituminous coal offers these advantages: (1) easier pulverization, (2) higher combustion rates with shorter flame, (3) fuel saving of 4-5% due to lower hydrogen content of char and reduced surface moisture, (4) simplified handling, and (5) practical elimination of spontaneous-combustion hazard. A promising new char-production system embodies such developments as the fluidization process used in oil refining and the flash pulverizer.

Use of earth-moving equipment has important advantages in handling coal, as demonstrated by 2 yr. of operation at a Canadian plant. —POWER

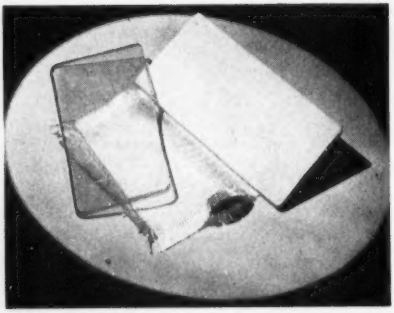


TELLS HOW MUCH WEAR—Increments of metal wear as small as 0.00001 in. can be measured by a new National Bureau of Standards method. A narrow diamond shape indentation is made in the working surface. This mark shows a definite change in one or more readily measurable dimensions after relatively small amount of wear. The technique overcomes the shortcomings of other methods, because it is not affected by shrinkage or distortion of part or wear on opposite side. A special McKee gage using microscope measures wear. Photomicrographs above show 0.0355 in. mark on engine cylinder before and after wear. —AVIATION WEEK

SEALS HIGHWAY JOINTS

Truck-mounted rig for filling longitudinal highway joints, developed by the California Highway department, fills two joints simultaneously with asphalt at temperatures of 350-400°F. Finished joint is neater and truer than hand-filled joints. Continuous circulation system prevents freezing of asphalt in pipes. Tank on truck holds 940 gal.

Truck operates at 1.5-1.8 mph., filling between 13½-19½ miles of joints per day. Highway officials believe rig will save $18 per mile of joints. After a day's operation, the piping system is flushed with distillate. —ENGRG. NEWS-RECORD



Both containing 10 layers of glass fabric, transparent laminate on left is made with new V-lite resin.

FOUR NEW PLASTICS WITH SPECIAL QUALITIES

Combining the toughness and chemical resistance of polyvinyl chloride with the solvent resistance and flexibility of nitrile rubber, Geon Polyblend 500x503 is useful for extruding and calendering and is adapted to embossing and press-polishing operations. This should make the B. F. Goodrich Chemical Co. product valuable to upholstery, shoe, electrical, and packaging industries.

Diallyl phenyl phosphate, or V-Lite, is a new colorless liquid plastic material soon to be made on semi-works scale by Victor Chemical Works. It polymerizes to become a transparent, thermosetting, hard, strong, flame-resistant resin. Sections up to ¼-in. thickness can be made at atmospheric pressure by curing 2½-3 hr. while raising temperature from 85°C. to 130°C. Among many suggested uses are: nonflammable coatings for decorations or veneers; windows in passenger aircraft, transparent laminates, copolymers for machine parts and optical uses.

Uformite F-240, a new butylated urea formaldehyde type resin announced by Resinous Products & Chemical Co., is said to be useful where low ratios of urea resin are required to speed baking. Its qualities tend to make it valuable in automotive and metal decorative finishes.

Geon 100-S-26 announced by Goodrich is a new free-flowing white powder readily dispersed in plasticizer with simple equipment. In coating operations, heavy equipment is not needed, and the shrinkage of fabrics commonly encountered in water or solvent system of coating is eliminated. Resin may be molded, cast, coated, or dipped. —CHEMICAL ENGRG.

PERSONAL PLANE VS. AUTO

Covering 6,447 miles in a 24-day sales trip in a 4-place *Navion* cost a Butler Mfg. Co. salesman $342, or 5.3¢ per mile. This included gas, oil, storage, maintenance, landing fees, and insurance. To make the same trip by car would require 6,989 miles of driving or about 175 hr. at 40 mph. Almost 9 hr. a day would thus be spent on the road at the expense of sales time. Butler believes airplane and airport-equipment salesmen receive better treatment by potential customers if they travel by air. —AVIATION WEEK

RADAR LIGHTHOUSE

Signals which will be detected through fog by radar-equipped ships are generated by a small radar beacon for lighthouses. The signals will appear as a bright ray on the ships' radar indicator, showing exact direction of beam. Developed by General Electric Co. for the U. S. Coast Guard, the radar transmitter uses a "lighthouse" tube operating at 3,200 megacycles. —ELECTRONICS

DUTCH HOT-AIR ENGINE

Construction of a hot-air engine on a commercial basis has been announced by Philips Incandescent Lamp Works, Holland. Efficiency is between that of gasoline and diesel engines. Fuel can be either gasoline, oil, methyl alcohol, or coal gas. Combustion is outside cylinders, and there is no chemical influence on pistons and cylinders.—PRODUCT ENGRG.

Fast Food Processing

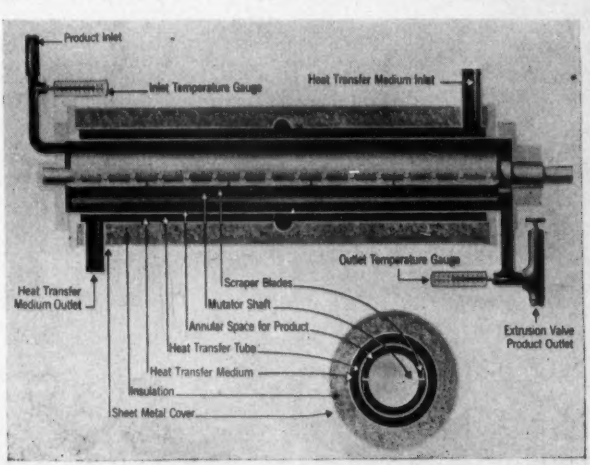
Votator which whips and quickly chills product in continuous flow greatly increases efficiency of margarine and marshmallow production

Modern margarine plant using a continuous process produces three times as much as the older batch plants, and with half the labor. One continuous process employs the Votator, originally designed for continuous ice cream manufacture. This is a continuous, closed, heat-transfer mechanism that simultaneously mixes and chills and delivers the finished product under pressure to the molding apparatus, ready for packaging. It consists of a tube with a rapidly revolving mutator shaft inside it and a larger insulated tube surrounding it. The product flows through relatively narrow annular space between mutator and inside tube, while the heat-transfer medium flows between the two tubes. Mutator scraper blades keep heat transfer surface clear of insulating film. This unit also has been adapted to continuous production of marshmallow for depositing on cookies.

In the continuous margarine process, a lactic acid culture is added to the pasteurized skim milk at 70°F., ripening takes place in 10-14 hr., then cultured milk is cooled to 40°F. Salt, benzoate of soda, diacetyl, and an emulsifier are added, with vigorous agitation. Then vegetable oils, lecithin, and vitamin A are mixed and added. After agitation, the emulsion is pumped to the Votator, where it is chilled instantly by the relatively large heat-transfer surface. A pair of Votators process 75,000 lb. of margarine in a 10-hr. day. The finished product discharges into a machine which molds it into 1-lb. prints. These are packaged automatically.

Advantages: (1) contamination prevented; (2) uniform product; (3) economy of operation; (4) low investment; (5) low fat losses and high yield.

Marshmallow Process—Sirup, gelatin solution, and air are metered into one end of the Votator and extruded from the other as thoroughly whipped, precisely aerated, and correctly cooled marshmallow. Savings are estimated at 66⅔% in labor, 50% in floor space. Clean-up is simple, hot water being passed through machines after day's run. Capacity of single-cylinder 4-in. Votator is 500 lb. per hr. —FOOD INDUSTRIES



Votator used in efficient continuous production of margarine and marshmallow. It chills product quickly while whipping it.

NEW PRODUCTS

Telescopic Conveyor—Gravity conveyors 20-, 30-, and 40-ft. long telescope into one 10-ft. section. Single section leg is adjustable for height, mounted on a 3-in. caster. Frame is of 1½x1½x3/16-in. channel iron. Pressure brake lock secures conveyor when in use. Conveyors are a development of Wilkie Co. —FACTORY

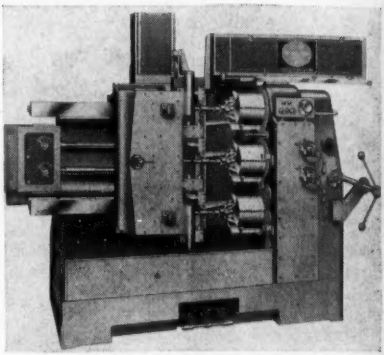
250-Amp. Selenium Rectifier—Produced by electrolytically depositing selenium, the 4-lb., liquid-cooled, cylindrical selenium rectifier developed by Ion Industries has 250-amp. capacity. A number can be connected in series or parallel. Applications include metal deposition, refining, surface treatment, and welding. —AMERICAN MACHINIST

2000° Insulation—Fibrous insulation composed of pure silica and capable of withstanding 2,000°F. continuously has been made commercially available by H. I. Thompson Co. Called Rafrasil, it is made in batts, 14 ft. long, 2½ ft. wide, 3/16 in. thick; cloth 32 in. wide and 0.015 in. thick; tape; and cord. —CHEMICAL ENGRG.

Anglevel—Usable from all four surfaces with vials in any position, a new level for construction work also has a dial and pointer to indicate angles. It is equipped with retainers into which two horizontal and two vertical vials are placed. Frame of R-D Co. Anglevel is aluminum, weighs 1½ lb., is 16x3x¾ in. —CONSTRUCTION METHODS

Small Snap-action Switch—Small, sturdy, compact snap-action switch is designed for use in electrical circuits of dispensing machines, automatic cookers, airplane wing flashers, and similar electric mechanisms. With high carrying capacity and long life, the switch is made both normally open or closed, with single- or double-throw single pole. The switch is made by Mu-Switch Corp., Inc. —PRODUCT ENGRG.

Heat-treats Fragile Parts—Automatic gas-fired machine for heat-treating fragile assemblies has been developed by Selas Corp. of America. It handles magnetic pull wires for business machines at 1,200 per hr. Steel wires with eyelets welded on ends are carried on rotating drum past burners and are quenched by water spray on side of burners. Second set of burners anneals weldments and applies water to eyelets so they will not anneal. —AMERICAN MACHINIST



THREE-SPINDLE LATHE—Multiple tools are mounted on vertical slide behind plate on which three spindles operate in Bullard Co.'s 3-spindle lathe. Tools work automatically, in sequence or simultaneously. Vertical placement provides easy access to work, allows chips to fall away from parts being cut, increases accuracy. Tool has 16 feeds, 40 speed ranges. —BUSINESS WEEK

Stone Entrances Packaged—Packaged stone entrance-ways now are available from Conco Building Products, Inc. Blueprints accompany package, giving laying details. Each stone is cut precisely and numbered for laying sequence. Any bricklayer can erect the doorway. —CONSTRUCTION METHODS

Speeds Bag Sewing—Cotton, burlap, or paper bags can be sewed at a rate of 100 per hr. with a new electric hand-operated bag closer. Operating on 110-volts, ac. or dc., closer is controlled by thumb-switch. It is a Bemis Bag Co. development. —FOOD INDUSTRIES

Plier-type Soldering Iron—About the size and shape of an electric razor, a new iron permits soldering in places inaccessible with standard iron. Plier-like carbon electrodes fit around object, pressure on handles turns on current. Adaptable to silver soldering, brazing, butt-welding, heat treating, tempering, and annealing of small parts, the iron operates on 6-volt ac. current. Triton Mfg. Co. developed it. —BUSINESS WEEK

Ceilometer—Continuous record of cloud variations is made by a complete ceilometer system introduced by General Electric Co. It uses a mercury-arc projector to cast a pulsed light beam into sky. A photoelectric detector located 1,000 ft. away and tuned to frequency of pulses measures light scatter from clouds. —ELECTRONICS

Kill Paint Odors—Unpleasant odors of fresh paint are claimed to be neutralized by a group of 10 deodorants developed by Givaudan-Delawanna, Inc., for a wide variety of paints. They do not affect qualities of paint and volatilize completely. Paint-O-Dors preferably are placed in vehicle or thinner during manufacture. —CHEMICAL ENGRG

Electronic Moisture Meter—Moisture content up to 85-90% is determined in 15 sec. with even-balance accuracy by a direct-reading, automatic electronic moisture meter made by E. J. Paterson Co. —FOOD INDUSTRIES

Precision U-gage—Operating on the U-type water column gage principle, the new F. W. Dwyer Mfg. Co. hook gage is more accurate than standard gages. Measurements are taken at center of column by needle-point hooks, attached to depth micrometers. Gage is made of transparent plastic with no moving parts. —ENGRG. NEWS-RECORD

Hydro-Copying Lathe—Operating on reproducing principle, a new Swiss lathe has a hydraulic copying system which follows templets. To permit tungsten-carbide tooling, a head and tailstock are joined and braced by massive overhead yoke in this machine of Geo. Fischer Steel & Iron Works, Ltd. Cutting edge of tool is to rear, and chips flow away from operator. There is said to be no chatter, even with ¼-in. cuts at 300 rpm. —AMERICAN MACHINIST

Remote Radio-Relay—Reliable, and consuming no standby power, a new radio-operated remote-control microsensitive relay responds directly to antenna current, closing on 8 to 10 millivolts, r-f. Developed by Donald G. Fink, editor of "Electronics," the relay is useful at unattended locations or as a carrier-failure alarm. —ELECTRONICS

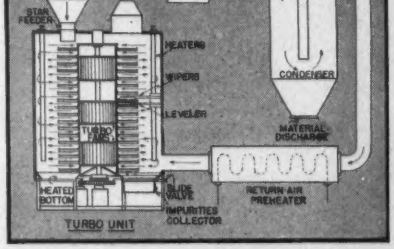
Asphalt Plant on Wheels—Designed for one-man operation, a light, inexpensive, portable asphalt plant will be built by Foote Co. for Ford Industries. It will use twin-pug-mill and produce 40-50 tons per hr. Pug-mill gate is air-controlled for instantaneous discharge. Heating drum raises aggregate temperature. Production is maintained by use of auxiliary drier. —CONSTRUCTION METHODS

Sharpens Contour Teeth—Contour-ground, form-milling cutters are sharpened by grinding on the periphery, rather than on the flat rake face of the tooth, by a machine which Cincinnati Milling Machine Co. developed. Teeth are ground by duplicating a master templet, tracing being hand controlled. Wheelhead swivel base carries a follower pin. Contour-ground tooth retains original shape and strength. —AMERICAN MACHINIST

Cooker Sets in Counter—Consisting of three heating units and a deep-well cooker, all with five heat switches, a new electric stove can be set into a counter top. Developed by Thermador Electrical Co., the unit is 17⅛ in. wide, 45 in. long, 10¾ in. deep, and is of stainless steel. —ELECTRICAL WORLD

Edible Iron Tablets—Ferrous sulphate is contained in bread-enriching tablets announced by Winthrop Chemical Co., Inc. The tablets disperse completely to assure uniform enrichment. —FOOD INDUSTRIES

Flux in Crayon Form—Convenient soldering flux in form of a crayon-like stick has been developed by Lake Chemical Co. This Flux-Stik is nonacid and nonrunning, can be applied to copper or brass. —ELECTRICAL WORLD



CONTINUOUS SUBLIMER—To achieve heat and product economy, continuous subliming unit using recirculated air has been developed by Wyssmont Co. It consists of vertical series of rotating trays, with heaters outside and central circulating fans. Spreaders level material on each tray, and after one tray revolution product is scraped through opening to tray below. Impurities collect at bottom for periodic removal without interrupting operation. Unit of same type will remove and recover solvents. Inert gas can be used as a vapor carrier to prevent explosion or decomposition.—CHEMICAL ENGRG.

NEW PRODUCTS

Conveyor Flow Meter—Dry materials moving along a conveyor belt are weighed continuously by the new Conveyoflo of Builders-Providence, Inc. The unit also will proportion and control, and it will regulate the flow of liquids in proportion to that of dry materials. One end of weighing section floats on a diaphragm which transmits load changes hydraulically to weighing mechanism. —FOOD INDUSTRIES

Bandsaw with Depth Control—Designed to cut off rectangular metal stock up to 12-in. deep by 16 in. wide, or 12¾-in. dia., a new horizontal bandsaw has automatic depth control for work on dies. Cutting head rides on rollers on two heavy columns; blade is fed into work at constant pressure by hydraulic power. Cutting speeds are 50, 90, or 150 fpm. for this No. 12 Wells Mfg. Corp. machine. —AMERICAN MACHINIST

Asbestos Dish Towels—Said to wipe dishes faster and drier, a 20% asbestos towel has been introduced by United States Rubber Co. —TEXTILE WORLD

SETS FENCE POSTS—A pile-driver on a power take-off from tractor or truck will place 200 fence posts per day. Pile-driver hammer weighs 260 lb. The pole-setter was developed by Northwest Tube & Metal Fabricators. —BUSINESS WEEK

For Airport Servicemen—To give protection to airport ground crews in inclement weather, a 2-lb., vinyl-coated nylon, two-piece suit has been designed by an American Airlines engineer. Basically a parka, the suit permits freedom of action, is wind and water resistant, pliable, easy to don, and does not get sticky when wet. Unaffected by oil, grease, gasoline, or salt water, suit can be wiped clean when dirty. Jacket has a waist draw-string, and full length zippered front. —AIR TRANSPORT

Precision Threading—Designed to eliminate many secondary operations and speed production on threads requiring very accurate lead, a lead-screw threading arrangement now is available for 6-spindle automatic screw machines of 1-, 1¼-, and 2-in. bar capacity. After quick approach, a leadscrew on end of driveshaft threads into a bronze nut, controlling threading-in of tap or die-head. Greenlee Bros. & Co. developed the system for its machines. —AMERICAN MACHINIST

No-smear Painting—Broad, arrow-shaped attachment, fitting any brush up to 1½ in. wide, prevents bristles from touching wrong surface during sash painting. When painting flat surfaces, guard is retracted. It is made by Sure Line Mfg. —BUSINESS WEEK

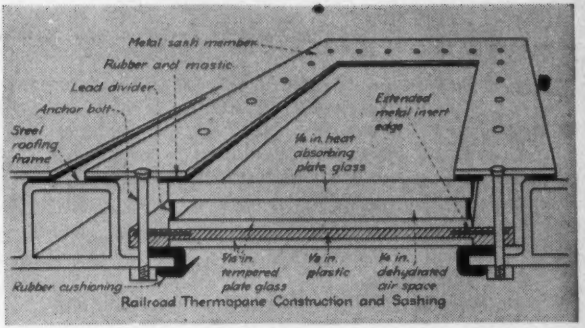
Measures R-F Inductance—For quickly and accurately measuring inductance of a radio coil, Wheeler Laboratories has developed a direct-reading meter. Two r-f oscillators, one with known inductance in series and the other with standard capacitance in parallel, are tuned to zero beat. Value of unknown inductance is then read on scale with 99% accuracy. —ELECTRONICS

Masking Liquid—Intended to take place of masking paper and tape, a new plastic masking liquid saves time and expense. It is applied with brush, dries in 5 sec. The Servwell Products Co. development is recommended for glass and all types of unfinished, plated, or finished nonporous metal surfaces, but not for rubber, wood, or natural lacquer. —CHEMICAL ENGNG.

Chemical Removes Milkstone—To be used in the cleaning of milkstone from utensils or dairy processing equipment, Pennclean contains a phosphoric acid base, a wetting agent, and a corrosion inhibitor. Pennsylvania Salt Mfg. Co. makes it. —FOOD INDUSTRIES

Light in Switch Handle—There is a neon-light in the handle of a wall-type light switch introduced by Roberts-Glo. Switch Div. It is on when lights are out, and out when lights are on. —ELECTRICAL WORLD

SAFETY WINDOW—Window in observation domes of the "Train of Tomorrow." Outside tempered glass is 3-5 times as strong as regular plate glass and slightly darker to reduce glare. Inner pane is laminated, tempered safety glass with polyvinyl butyral inner layer, also tinted. Air space between panes is dehydrated. Sashing is "flexible" to yield, not shear, under impact. —PRODUCT ENGRG.



Railroad Thermopane Construction and Sashing

New Waterproof Membrane—Of inorganic, rot-proof, open-mesh Fiberglas yarn, a new waterproofing membrane is designed for roofing applications, waterproofing brick or concrete walls above or below grades, and other waterproofing jobs. Waterproofing compound is applied to open mesh, the impregnated fabric adhering firmly to rough or irregular surfaces. Hot mopping does not damage glass yarn. Lexington Supply Co. developed the membrane. —CONSTRUCTION METHODS

Capacitor Improvement—Power-factor capacitors using cast glass bushings with integral hardware that permits a permanent hermetically sealed unit have been developed by General Electric Co. —ELECTRICAL WORLD

Supersensitive Air Meter—Air velocities as low as 5 fpm. are said to be measured accurately with a new Hastings Instrument Co. meter. Pick-up is a noble-metal thermopile in air stream. Alternate junctions are arranged to have much greater cooling than adjacent ones heated by alternating current. Temperature rise of warmer junction is measured by dc. voltage generated. —CHEMICAL ENGRG.

Feeds Presses—Low-cost, automatic, friction-roll unit feeds metal, wood, plastic, or cardboard into punch presses. Up to 3-in. adjustments in feed are possible through friction drive. It handles widths up to 3 in. Spring-loaded housing adjusts for thickness variation up to 3/16 in. It is a Beachmaster Mfg. Co. development. —BUSINESS WEEK

Cooled Flexible Conductor—New water-cooled flexible conductor for high-power, high-frequency current has been developed by Titeflex, Inc. It has a water-tight convoluted brass innercore with an outer braid conductor. Special extruded insulation covers the braid. —ELECTRICAL CONST. & MAINT.

Carbon-ring Oilseals—For shafts where minimum lubrication is used, where seals run in liquid rather than oil or grease, or where shaft speeds are high, new high-speed carbon-ring oilseals have low friction and self-lubricating qualities. They seal against leakage of liquids or gases under pressure or vacuum by a radial joint between stationary and rotating lapped surfaces. Gits Bros. Mfg. Co. developed them. —POWER

Better for Planes—A 130 octane aviation gas that will operate efficiently at temperatures as low as -50°F. is being developed by Shell Oil Co., Inc. . . . Texas Co. has announced a lubricant for plane landing gear that withstands temperature range from +175°F. to −67°F. —AVIATION WEEK; AIR TRANSPORT

Handy Hand Truck—Loaded boxes weighing up to 600 lb. can be picked up directly from the floor by a new two-wheel hand truck of Food Machinery Corp. Steel arms operated by a pedal squeeze ends. —FOOD INDUSTRIES

Vertical Mercury Switch—As safety controls for equipment whose mechanism might be damaged by operation after tipping or upsetting, vertical mercury switches have been developed by Minneapolis-Honeywell Regulator Co. —ELECTRICAL WORLD

FREE SERVICE TO READERS

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Atomic Energy and Medicine

Development of radioactive isotopes necessitates a complete reexamination of physiology, medicine, biochemistry. New treatments with isotopes

Nucleonics is becoming a common term in the medical field as well as in the field of power. The cyclotron and the chain reacting atomic energy pile will prove as important to medicine as the development of the microscope. They are important through their production of radioactive isotopes. The entire fields of physiology, medicine, and biochemistry are now being reexamined in the light of these radioactive elements.

These theraputic agents—radioactive isotopes—emit alpha, beta, and gamma particles, all having applications in diagnosis and treatment of disease. The alpha particles, since they do not penetrate the skin deeply, are used in the treatment of skin diseases, radiation injuries, burns, vascular diseases, and other similar conditions. Beta particles, carrying negative charges, have not found definite therapeutic use. Gamma rays have deep penetration characteristics similar to x-rays.

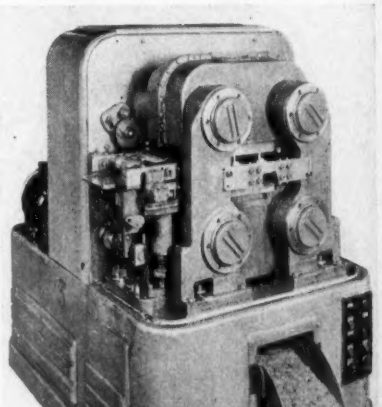
Radioactive phosphorous is now being used to treat leukemia. Radioactive sodium phosphate is injected into the blood stream, serving the same purpose as x-rays in fighting the blood disease. It is also being used to combat polycythemia vera (excessive red blood cells in bone marrow), lymphatic leukemia, and plasmocytomia.

Good results have occurred in treatment of hyperthyroidism with radio-active iodine, which also can be used to treat cancerous tissue of the thyroid without danger to the parathyroid.

Behind all this medical research with radioactive isotopes lies the hope that some chemical substance will be found that will lodge in the cancerous cells; this chemical, with a radioactive element attached, may prove to be a more effective cancer treatment than currently exists.

Radioactive inorganic ferric salts given in tests to normal and anemic dogs showed that the anemic dogs absorbed 4.1 to 12.7% of the salts and that normal dogs absorbed only 0.08 to 0.24%, most of the iron being present in the hemoglobin of the dogs.

Similar radioactive isotopes may be



FAST ROTARY-ACTION PRESS—Stock is cut while in horizontal motion through press by rotary-motion dies in an extremely high-speed (1,800 strokes per min.) punch press developed by Lempco Products, Inc. Unit uses four crankshafts, upper two rotating clockwise to drive upper diehead; lower two, counterclockwise to drive lower diehead. Punch holder is fastened to upper head, die-holder to lower head. Punches and dies have same rotary motions as respective dieheads, closing and opening with each crankshaft cycle. Stock is fed by friction rolls. Sizes are 10 and 50 tons. —AMERICAN MACHINIST

used to study enteric coats, stomach, intestinal, and skin absorption, and other medical problems. —PHARMACY INT'L.

MECHANIZED HANDLING FOR MAINTENANCE WORK

Mechanized materials handling equipment is as applicable to maintenance repair work as it is to production line work. Using this equipment for maintenance and repair of its large furnaces, Bethlehem Steel Co. has reduced overall maintenance costs, improved quality of work, and increased safety during repairs. Portable belt conveyors, fork-lift trucks, pallets, and vacuum conveying systems have replaced the shovel and wheelbarrow.

Equipment has been installed only where jobs are sufficiently large or repetitive enough to warrant. In repairs of "checker" chambers or relining a furnace, conveyor is used to move brick outside. Previously, bricks were dropped one at a time through the door. Now they are dropped onto conveyors, and pickers salvage usable brick while the useless brick is dumped directly into railroad cars for removal. Bricks are handled at the rate of 16-22 cu. ft. per hr. against the previous hand rate of 8 cu. ft. per hr.

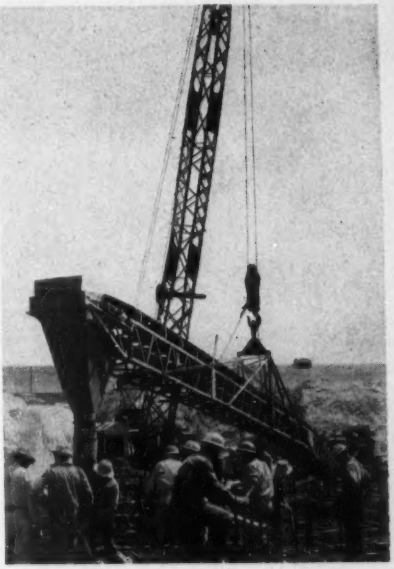
Eight handlings were used originally to move 9-in. brick from siding to repair site. Now bricks are stored 360 to pallet, handled twice. Former equipment handled 8 bricks per trip. —FACTORY

WASHER RECLAIMS COAL

Minus ¾-in. mine refuse, picking-table reject, and bank material is reclaimed by a new washer developed by Coal Cleaner Co. Six K Coal Corp. uses it to recover about 200 tons per day. Product is claimed to be equal or better than regular deep-mine output.

The unit has a 50-ton-per-hr. capacity, is 50 in. wide and 22 ft. long, and has a crescent shape. Raw feed is carried down an inclined conveyor into a calcium chloride wash. As convevor moves through wash, coal floats and is taken to discharge end. Refuse in the bath falls to bottom and is carried out by conveyors.

Reclaimed coal is moved by conveyors to railroad loading ramp. —COAL AGE



CONCRETE WHERE YOU WANT IT—As fast as transit-mix trucks can maneuver into position and unload, concrete is placed exactly where wanted by this 100-ft. crane-supported belt conveyor. It speeds placing of 18,000 cu. yd. of concrete in construction of Los Angeles municipal Harbor Steam Power Plant.—CONSTRUCTION METHODS

NEW WELDING METHOD

Russia claims new method of welding increases speed five to ten times, making it possible to weld 500 to 650 ft. per hour with accompanying saving in power and increased quality. Two pieces are fused, then filler metal comes to joint in molten state. —WELDING ENGINEER

BABY TURBOJET—Weighing but 85 lb., this Boeing Model 500 turbojet develops 150-lb. thrust. It may be used as starter for large jet engines, as propulsion unit for guided missiles, glide bombs, and small planes. It is 29 in. long, minus tailpipe, and has 22-in. dia. Common shaft connects turbine wheel and centrifugal compressor. Burner temperature is 1500° F. —AVIATION WEEK

KILOWATTS DRY INK FOR FAST PRINTING

Two years of development by Commonwealth Edison Co. has produced a high-speed electric ink dryer for printing presses. Alloy resistance heater rods of 5/16 in. square cross-section rest in slots of ceramic plates to form a rectangular-grid panel. These operate at 2350°F., heating the air to 800°F., the printed paper to 300°F. Heater panel and reflector are about 1-in. apart when paper is moving through. If paper stops, a heat-resisting curtain automatically comes between it and heater. A blower and ducts on heat-insulated back of reflector panel draw heated air from top for return to bottom. Dampers provide temperature control. To avoid overheating at center, any or all center heating elements can be short circuited. Saturable-core transformers with thyratron control will be added.

The dryer is designed for high-speed web presses. —ELECTRICAL WORLD

COLORED RADIO FACSIMILE SIMPLE WITH NEW UNIT

Color printing by radio facsimile now looks probable in the near future. A new low-cost receiver, requiring no special paper, prints picture without developing or processing. Called Colorfax, the process is a development of Finch Telecommunications, Inc.

At transmitter, colored picture is affixed to a rotating drum, a pinpoint of light being focussed on it through a colored filter causing successive rays of red, blue, green, and amber light to hit picture. Light moves paralled to drum's axis. Intensity of transmitted signal is controlled by amount of light reflected to electric-eye tube, each color reflecting a different amount of light.

These signals can be transmitted by wire, telephone, or radio, wire being the slowest. In pilot model, telephone transmission produced an 8½-in. wide picture at a vertical rate of ½ ipm. Radio signals will print twice as fast; special receivers may increase vertical printing threefold.

The receiving unit, essentially a robot crayon artist, colors in cyan, magenta and yellow, supplemented with black. Crayons, set in electromagnetic holders, travel horizontally from left to right, paper moving vertically. Electronic signal energizes crayon holder, ejecting crayons singly or in multiples. If all crayons were either black or white, a black-and-white picture would result at speeds much greater than current speeds.

Suitable crayon leads of proper brilliance and a means of reloading crayon holders remain the principal drawbacks to the process. Finch hopes to sell the receiver at $100. —BUSINESS WEEK

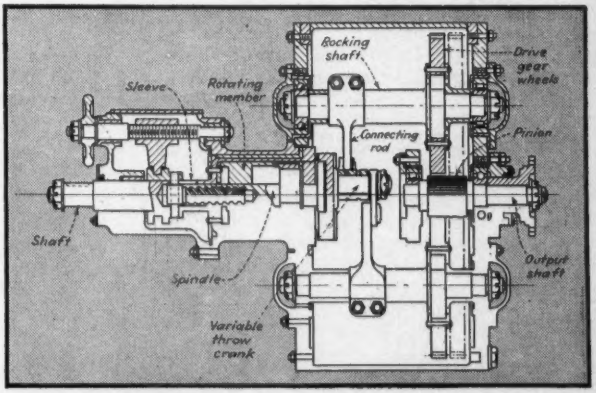
Digging Deep for India's Gold

Increased efficiency with air conditioning will permit economical operation at 11,000-ft. depth. Other improvements also have been made

Immediate and substantial improvement in the amount of work done followed installation of air conditioning in the 9,000-ft. mines of India's Kolar Gold Field, where rock temperature is 140°F. Development footage per machine month jumped 25%; amount of granite supports built in stopes rose 100%; other work improved similarly; and the accident rate dropped 30%. Great weight of downcast column of air from surface cooler provides natural ventilation, and ventilating fans were stopped. Consumption of compressed air decreased due to cessation of miners' practice of "blowing off" to keep cool. These power savings equal power required to run cooling plant. The mines now can go deeper, 11,000 ft. being planned.

Rockbursts have been reduced by rigid granite walling and by orderly sequence of stoping. If an oreshoot can be worked out from one boundary to the other by a series of stopes, with their faces more or less in a continuous line, liability of rock bursts is reduced to a minimum. On the levels, through which passage is required for rescue or repair work, a lining of steel rings is universally used. Since much trouble is experienced with winze linings, tendency is to reduce winzes in ore between levels to one per oreshoot. Because of heavy stresses, elliptical shafts are used, these being lined with concrete, with or without reinforcement.

Use of timber is minimized to prevent fires. To facilitate isolating potential fires, the mines are divided by "seals" into sections. Seals largely follow natural division between oreshoots, but are carried across stoped ground where necessary by a bar of sand-filling or concrete. Winzes and levels passing through seals have steel doors which can be covered with sand to make them gas-tight. As a fire warning, eucalyptus oil is poured into the compressed-air main at surface. The pungent smell issuing from the exhaust of every machine soon permeates the entire workings of the deep mine. —ENGRG. & MINING JOURNAL



UNIQUE VARIABLE-SPEED GEAR — Four one-way drive gears on shafts rocked by connecting rods and variable-throw crankshaft drive output shaft of new variable-speed unit. Developed by McEwan & Neave, Glasgow, gear transmits 7 hp. at 500 rpm. input, with speed of output shaft infinitely variable from 0 to 1,000 rpm. Crank is on spindle, eccentrically mounted in rotating member and adjustable by axial screws in shaft. —PRODUCT ENGRG.

NEW SYSTEM SPINS YARN FROM CARD SLIVER

Spinning of yarn directly from card sliver is now possible with the Arondale Mills system. Yarns from card sliver, drawn sliver, and slubber roving as coarse as 0.20 hank have been spun successfully. System has handled drafts up to 300, and drafts up to 600 have been tried experimentally. Yarns up to 40s spun on the system are more even and have breaking strength equal to that of yarns spun on standard systems.

Five pairs of rolls and two pairs of short carrier aprons are used. From back trumpet, stock is taken by feed rolls. Next pair of rolls are knurled. Each of these rolls drives a short apron mounted on a cradle to present a horizontal working surface to carry the ribbon of fibers to middle pair of rolls. From another pair of rolls, stock is condensed by trumpet and enters second pair of carrier aprons.

Roll-weight system consists of dead weight suspended under roller beam by hook. By levers and bars, pressure is transferred to front saddle resting on front and second rolls and to a middle saddle resting on middle roll and back saddle. This back saddle weights fourth and fifth rolls. Flat under-cleaner, held by small weights, bears against middle and fourth rolls. Two flat top cleaners rest on second and third and fourth and fifth rolls. Revolving cleaners are used on front rolls. —TEXTILE WORLD

HYDRAULIC BUS CONTROLS

Brakes, clutches, doors, and windshield wipers on one Detroit Street Railway bus have been operated hydraulically through 58,000 miles without preventive maintenance. The company believes hydraulic actuation will eliminate some of the problems inherent to air systems, give better performance, and reduce maintenance. System operates at pressures between 800 to 1,100 psi., the pump operating or cutting out automatically when critical points are reached.

Storage accumulator, an 8-in. dia., hollow steel ball, is divided into two halves, separated by a synthetic diaphragm. One side confines permanent charge of compressed air, acting as a spring against the oil stored on the opposite side of the ball. —BUS TRANSPORTATION

GOOD FOUNDRY TECHNIQUE

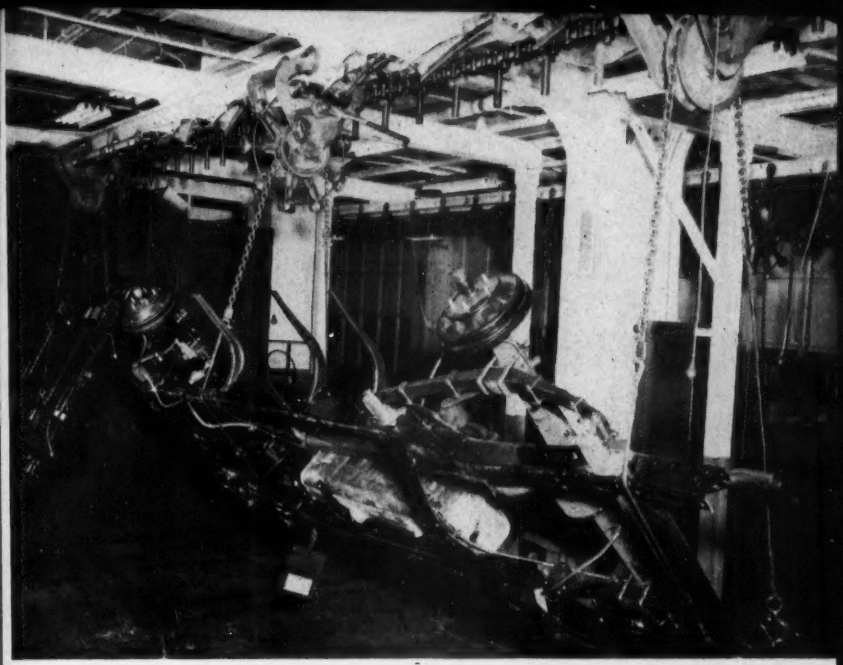
To obtain high-strength, well-proportioned parts in steel castings, designers should pay particular attention to directional solidification. If a section is tapered somewhat, and the hottest metal is at the top, wide, portion of the section, solidification will progress from sides and bottom in such a way that no cavities or pipes are produced in the metal. Tapers of 5 deg. are helpful; 10-15 deg. better. Relatively large-radius fillets should be used.—PRODUCT ENGRG.

AIDS OIL EXTRACTION

Liquid extraction methods using isopropanol and mixtures of isopropanol and hexane have proved beneficial in the extraction of gassypol, oil, and other substances from cottonseed. In pilot-plant operations, cottonseed flakes moved countercurrent to preheat solvent, then out of the solvent and through a steam-jacketed drying section. Extractions were with 91% isopropanol, 99% isopropanol, and mixtures of isopropanol and hexane.

The 91% solution provided an efficient solvent for extracting active gassypol and oil; 99% solution resulted in a light meal but not so much gassypol. Hexane-isopropanol proved as efficient as the other solvents.

It was found necessary to increase moisture content of meats 10-12% before flaking, since solvents did not percolate well through meats. When 91% isopropanol was used, solvent was preheated to 170°F. or higher, then maintained at 160°F. —CHEMICAL ENGRG.



Recently installed in Ford plant, monorail hoists pick up frame assembly and move it along by auxiliary line conveyor with manual pickoff. Cam-actuated device turns frames 90 deg.

BETTER MATERIALS HANDLING

— *Report to Management* —

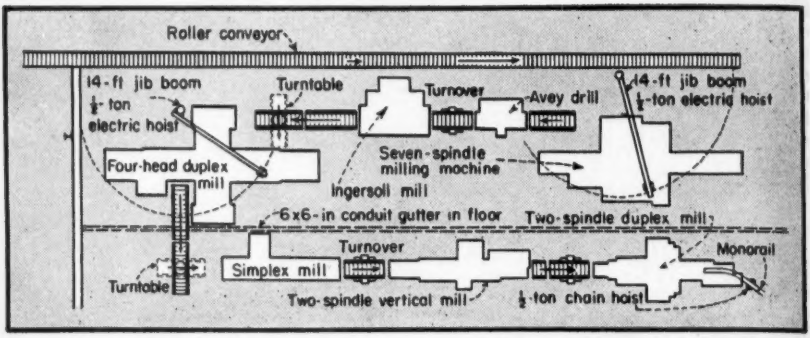
An easy way to speed production, reduce costs, improve quality, make work lighter, and increase wages is to mechanize the handling of materials. Valuable time also can be saved in loading and unloading freight cars, trucks, and ships. Recent achievements are reported here. Equipment suited to different operations is discussed.

EFFICIENT handling of materials through factories and warehouses is as important as improved processes in cutting costs and speeding production. It has become the pipeline of production and the pace-setter for production-line workers. It has replaced muscles with machines, to reduce the nonproductive effort of high-cost labor and make jobs easier, safer, and more desirable for workers. It has, in fact, become an integral part of the modern production setup.

What this strong emphasis on materials handling is achieving can best be visualized by considering some actual instances in industry:

Will Save $100,000 a Year—Yearly savings of almost $100,000 a year are expected at Weatherhead Co. through seven conveyor systems linking operations in three multistory buildings, and the system will pay for itself in 4 yr.

All of the washing, drying, weighing, and bright-dipping operations are carried out by the



Diesel cylinder blocks weighing 900 lb. are transferred from operation to operation with little effort and no congestion in Buda engine plant. Roller conveyors, hoists, turntables and turnovers do the job. Monorail conveyor takes blocks to the next department.

conveyors, with 40% labor saving. Material flows through the plant 20% faster, reducing work-in-process inventory one-fifth.

Conveyors Connect 152 Tools—With a line of 152 machine tools connected by automatic conveyors, it is possible to produce 188 cast iron refrigerator bodies per hour at 80% efficiency. The 98-ft, 8¼-in. machine mills, drills, bores, reams, chamfers, and taps in prearranged sequence. It has 24 stations and performs 31 different operations on each part. Much emphasis is being placed on automatic transfer and conveying devices in machine shops to reduce high labor costs.

Mirror Production Increased 60%—A mirror manufacturer increased production nearly 60% and reduced the labor involved by almost half when he installed steam-heated belt conveyors, so timed that chemical deposition is completed just as the mirrors are transferred to a slat conveyor which carries them through rinsing, drying, and spraying operations.

Warehouse Efficiency Up 60%—Delivery to warehouses, sorting of products by type, and final shipment is accomplished at Kellogg Co. by belt conveyors, conical sorting tables, and fork-lift trucks and pallets. Warehouse efficiency is increased 60%, unit costs are lowered, and shipping speed is improved 12% by the system. Practically all hand work has been eliminated.

In this system, a double belt, ½ mile long, connects the production department and the warehouse. The two conveyors empty onto two 30-ft. dia. conical sorting tables in the warehouse. These tables revolve slowly, and the cases ride around on their perimeters. Cases are sorted and placed on pallets which are moved to the storage area by a fleet of sixteen 3,500-lb. capacity fork-lift trucks.

Textile Mill Savings—Analysis of actual and estimated costs of operating a 40,000-spindle cotton mill during a 120-hr. week showed motion- and time-study men that intra-process materials handling cost operators about $10,000 a week, or about 70% of the process cost. Semi-mechanized handling in spooling, warping, and slashing operations has lowered handling costs, and it is suggested that similar applications in warehouse, card, spinning, weave, and cloth rooms would effect similar savings.

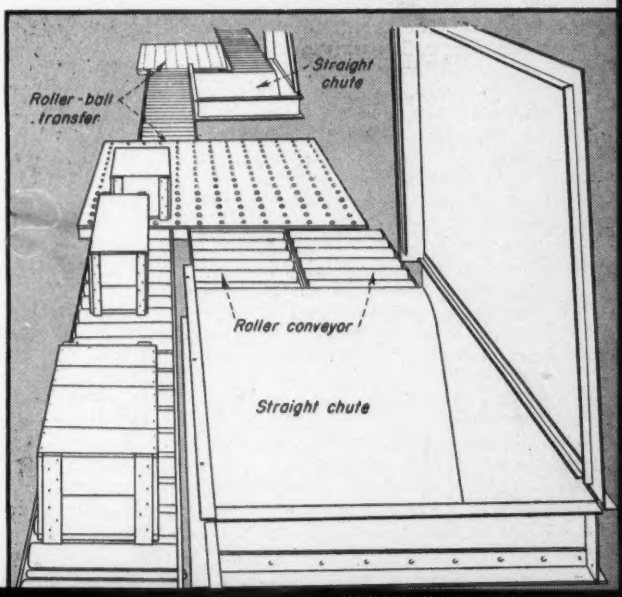
Carbon Black Handled in Bulk—At O'Sullivan Rubber Co., an inclined screw conveyor moves bulk carbon black from a pit beneath the railroad siding to an enclosed bucket lift 165 ft. long. The

buckets empty into a 25-ft.-long screw conveyor, which moves the carbon black to a storage bin atop the building. From this bin, the material travels by chute to production locations. The system has lowered cost through bulk buying and reduced contamination of products from carbon particles in the air.

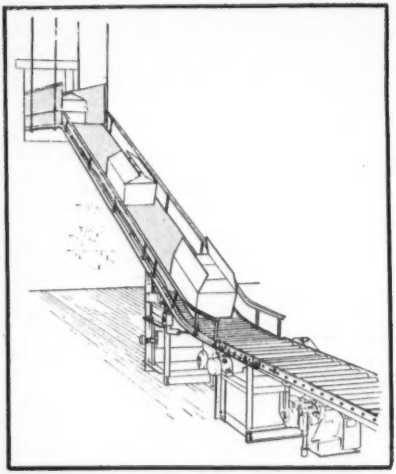
Iron Ore Moves on Belts—Operations in several different buildings are efficiently tied together with enclosed conveyor belts at Tennessee Coal, Iron & Railroad Co.'s big central plant for crushing, screening, and blending iron ore. A two-car rotary dump feeds the primary crushers, then the ore is conveyed on 36-in. belts to surge bins. From these, the ore is fed by vibrating feeders into cone crushers, then collected on a 42-in. belt, weighed on a conveyor scale, and carried to the screening plant. Other 36-in. conveyors take coarse and medium grades over a weigh station and to 800-ton silos. A series of 30-in. conveyors carry the fines over a scale to the sintering plant bins. Each bank of 20 silos has a separate proportional feeder for each four silos, and five different ores are assembled by remote control by the blending-plant operator. The discharge hopper for each group of four silos empties onto a vibrating feeder, electrically controlled by a 60-in. weigh belt. Five belts feed from the coarse-ore silos to the main blend belt, and a similar setup is installed under the medium-ore silos. Both sets of feeder belts discharge to their own 36-in. blending belts. In the silo-control room, the operator takes the practice man's sheets, opens correct silo gates, starts the weigh belts, and sets the individual indicator dials to the prescribed feeding rate. Handling in the sintering plant is also mechanized.

Lift Trucks Do Heavy Work—Heavy lifting and transporting in the Tennessee plant of Aluminum Co. of America is done by 111 battery-powered trucks. All movement in and out of storage is by fork-lift trucks, cases being steel-strapped to pallets. By piling the pallet loads high, space is effectively utilized. Scrap is handled in metal skid boxes by lift trucks with forks which have a rotating head to dump the scrap at the baler. Heavy coils of aluminum strip are stacked on skids and moved in 12,000-lb. loads to the annealing furnace by a platform lift truck of 20,000-lb. capacity.

Conveyorized Pickling—Pickling operations in the modern and highly efficient



Combination of roller conveyors, chutes, and roller ball transfer tables effectively handles heavy boxes, permits flexibility in routing.



Packages from upper roller conveyor are lowered by belt to a roller "cleanout" section and a live-roller unit heading to shipping room.

washer-tub enameling plant of Landers, Frary, & Clark are based upon a conveyor system. The part is carried by an overhead monorail conveyor through a U-shaped tunnel where it passes in sequence through these sections: emulsion cleaner, rinse, alkali cleaner, rinse, sulphuric acid, rinse, nickel sulphate, rinse, neutralizer, and hot-air blast. Besides a 50% gain in production, the installation improves quality and reduces costs. Subsequent handling also is mechanized.

Speeds Watch Making—Assembly of watch components by soldering is facilitated at Telechron, Inc., by a conveyor. Two women assemble parts and solder rings, and a third slips the assemblies onto an endless spiked chain which carries them past heating torches.

Output Raised 400%—Horizontal and vertical conveyor systems at the 5-story extinguisher factory of Randolph Laboratories, Inc., have increased output 400% at one-half the cost. They also have increased floor space for production operations 60% and improved quality.

Groceries Assembled—Using a flexible low-cost materials handling system, a large National Tea Co. warehouse assembles 1,200,000 lb. of grocery orders a day for delivery to Chicago stores. A fleet of 49 electric industrial tractors pull trains of three or four hand-truck trailers through the aisles of a 50,000 sq. ft. order-picking space, and the goods are taken from stacks and loaded onto the trailers. Other large warehouses use trucks pulled by an overhead chain conveyor to move materials efficiently.

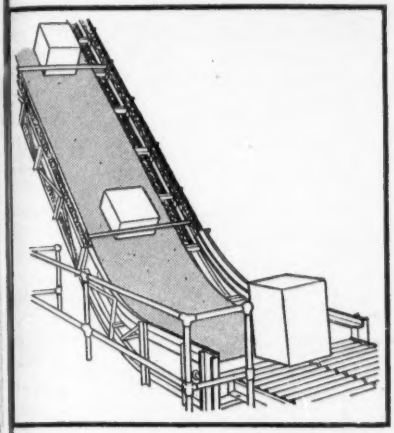
Power Shovel Handles Chemicals—In an efficient new fertilizer plant, cured superphosphate is broken up with a light explosive then transferred to electric trucks by a small power shovel on a caterpillar tractor. Other materials handling equipment in this factory includes vertical elevating conveyors, belt conveyors, pumps, and stevedore trucks.

From the foregoing few examples, it may be surmised that the applications of materials handling equipment are widely varied in industry, in small as well as large plants. Certainly there are few movements of materials which cannot be mechanized or semi-mechanized profitably. Exactly what equipment to use for a particular operation is a problem to be determined by an engineer who understands all local factors involved and knows materials handling principles and equipment. The different types of equipment available and the operations to which they are suited are discussed below.

Conveyors for Fixed Routes

Where there is more or less continuous movement of materials over fixed lines of travel between fixed points, conveyors will do the job efficiently. Widely separated departments function as a unit when connected by conveyors, and workers in a department are paced for higher productivity by the speed of a conveyor.

Gravity—Conveying by gravity roller, wheel conveyor or chute affords, where practical, the simplest and most eco-



Parts and packages are elevated to higher levels by pusher-bar conveyor. Moved by power-driven chains, bars slide objects up incline.

nomical means of transporting material. Live roller conveyors, on which the rollers are power rotated by an endless belt or by chain and sprockets or gears, do not depend upon gravity. These have the valuable feature that packages may be stopped and allowed to accumulate without excessive wear and tear, as with some other types of power conveyor. Spiral conveyors, either roller or chute, are efficient in lowering materials from floor to floor, and they require relatively little space.

Belt—Power-driven belt conveyors have long been used to convey bulk materials, and in recent years have found wide application in package conveying, assembly and inspection operations, and processing. Small parts or products spread out on a belt conveyor are readily accessible to workers stationed along the belt for inspection, grading, assembly, or packaging. A parallel belt can carry assembled or packaged parts, or pieces which have been sorted out. In processes requiring passage of air or liquid over the product—as in freezing, drying, or washing—wire mesh conveyors sometimes are used.

In ordinary package handling, belt speed ranges from 50 to 100 fpm. Rough-top belts operate on inclines up to 28 deg., but should have a flat or slightly inclined feeding section for any slope over 15 deg.

Chain—The overhead trolley chain conveyor is a simple, flexible, and economical device for moving materials. It saves floor space, permits straight-line production without costly remodeling of the building structure, and serves as a mobile storage from which a steady supply of materials flows to machines or assembly points.

The trolley conveyor is arranged as an endless circuit of monorail track beneath which moves an endless power-driven chain connected to trolleys at regular intervals. The trolleys carry loads by means of hooks, racks, suspended trays, or special carriers. The line of travel may include horizontal bends up to 180 deg. and inclines of 45 deg. Special installations have been made where the load is carried vertically. Small parts now are carried to assembly-line supply bins by buckets on trolley conveyors and dumped into bins manually or automatically.

In-floor conveyors power driven through chains also have wide application in moving material from department to department and through the process.

Slat, Apron—Chain conveyors continuously surfaced with metal or wood slats or aprons to form a "belt" are adaptable to products of such nature or weight unsuitable for other types of conveyors. These are widely used for such purposes as the progressive assembly of refrigerators. Permissible inclination is about 10 deg. with smooth slats, 45 deg. when cleats or flights are used. Speeds usually are 30-40 fpm. but may be 100 fpm.

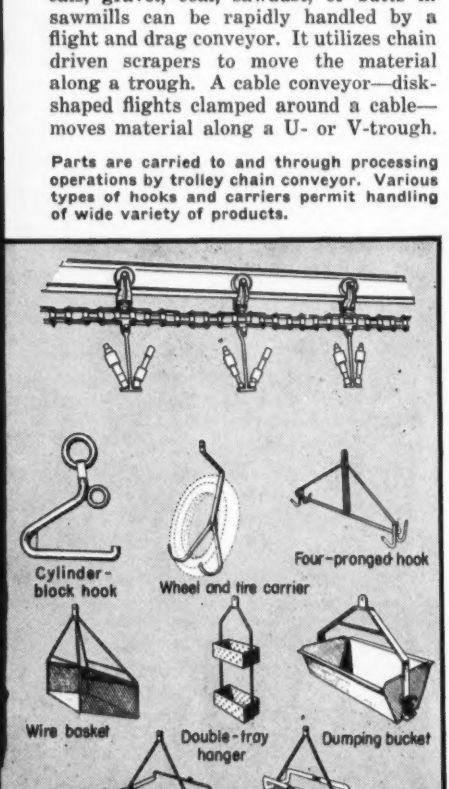
Roller "slats," closely spaced to form a continuous traveling bed, are advantageous where it is necessary to stop materials in transit. Since the rolls turn

when the load is stopped, little friction is developed.

Pusher—For elevating or lowering at 30-60 deg. or greater angles, pusher-bar conveyors frequently are used, being low-cost, adaptable to automatic loading, and simple to operate. These are used extensively in gravity roller systems to lift packages from one section of roller conveyor to the next. These boosters may also have slider beds, and the pusher bars are attached between parallel power-driven chains. Average speed is 40 fpm.

Drag—Bulk materials such as chemicals, gravel, coal, sawdust, or butts in sawmills can be rapidly handled by a flight and drag conveyor. It utilizes chain driven scrapers to move the material along a trough. A cable conveyor—disk-shaped flights clamped around a cable—moves material along a U- or V-trough.

Parts are carried to and through processing operations by trolley chain conveyor. Various types of hooks and carriers permit handling of wide variety of products.



Elevators—For moving small parts and packages vertically, conveyors consisting of endless chain with free-swinging suspended trays are highly useful. They also can operate horizontally and therefore efficiently tie together departments on different floors. They will bring empty cartons to a packaging operation and take full ones away.

Parallel chains with rigid arms attached are the simplest type for elevating or lowering packages vertically or at steep angles. Packages and rolls can be picked up and discharged automatically. Speeds are 30-40 fpm.

For bulk materials, bucket elevators are widely employed. Attached to chains or belt, the buckets pick up the material in a boot at the bottom and dump it as they pass over the head wheel.

Reciprocating lifts, with roller or plain platforms, are economical for intermittent vertical handling. Standard lifts also move materials from floor to floor, and hydraulic lifts raise loads to truck or machine loading levels.

Pneumatic—Fast and efficient for special purposes, pneumatic conveyors, using compressed air or vacuum as the propelling force, handle free-flowing bulk solids or cylindrical tubes carrying papers, blueprints, and small tools and parts.

Tube—Loose bulk materials also are effectively moved through tubes by skeleton flights attached to a chain. An important advantage of this conveyor is that it will operate horizontally, inclined, or vertically, and around bends, all in one continuous run. It also is automatic loading and unloading.

Reciprocating—For handling somewhat sticky material, as raw sugar, the grasshopper conveyor finds application. Upward and forward movements of the conveyor trough impart a hopping movement to the material. Not only is it self-cleaning, but it handles sugar without grinding the crystals.

Bulk materials of an abrasive nature,

as foundry sand, often are handled by a reciprocating flight conveyor because of relatively small amount of wear. Flights or pushers mounted underneath a reciprocating steel frame push the material along a trough. As the flights move back, they raise, then lower for the forward trip. The wearing parts are above the abrasive material, and clearance between flights and trough bottom permits the material to slide on a layer of the material itself, reducing wear.

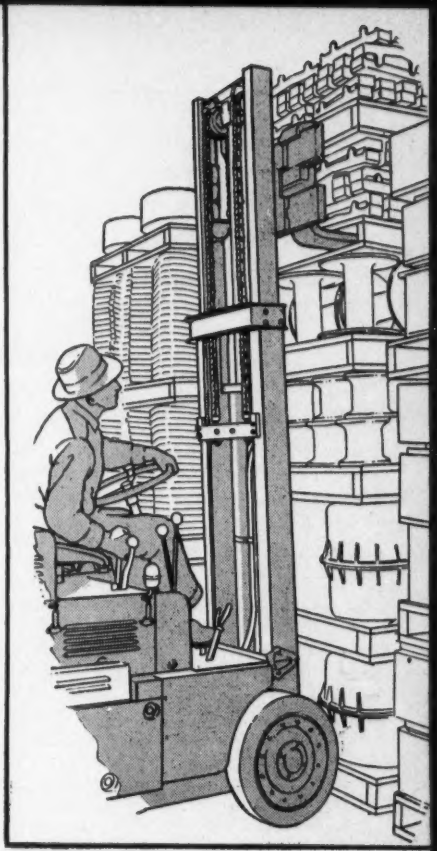
Electromagnetically vibrated troughs and chutes have come into use for conveying loose materials and for feeding these into packages or processes at a controlled rate.

Screw—Bulk products such as grain, meal, cork, sawdust, and coal often are moved horizontally or on an incline by a screw conveyor. It consists of a helical metal ribbon, or screw, on a power-driven shaft and enclosed in a long cylinder. A pre-freezer for food products consists of such a conveyor surrounded by a jacket and equipped with a hollow screw through which cold brine is circulated.

Sling Belt—A sling conveyor, or "banana carrier," is employed to move materials to or from shipside, and out of the holds of vessels. A continuous strip of canvas is supported on crossbars attached to two parallel sprocket-driven chains. The canvas sags between bars to form slings to carry the material. An important advantage of the conveyor is that it can operate both horizontally or vertically, or on an incline.

Bucket—Used for handling coal and ashes in power plants, as well as chemicals, the pivoted-bucket conveyor operates horizontally, vertically, or on an incline, and can be loaded and unloaded automatically. Suspended between two endless chains, the buckets overlap on the horizontal run to prevent spillage in filling from a hopper. They are emptied at the proper point by a tripper.

Portable—Portable conveyors, including telescoping and new flexible types which bend around corners, are finding



Pallet loads of many shapes and sizes can be transported and stacked to high levels by fork-lift trucks.

increasing application. They are particularly useful for such purposes as loading and unloading cars and handling materials at temporary locations.

Pumps—Progress in handling fluid materials by pumps and pipes has come from the application of corrosion-resistant equipment. Glass pumps and pipes are available, having the advantage of product visibility. Metals that resist corrosion also are used in this type of materials-handling equipment.

In a recent novel application, small fish

Low-cost hauling over long routes is effected by the tractor-trailer train, used in combination with a fork-lift truck for loading and unloading trailers.

are pumped from the holds of ships through a flexible hose. Water is first discharged into the hold to make the fish "fluid."

Industrial Trucks Flexible

For intermittent movement of materials in and about a factory, warehouse, or wharf, industrial trucks are most flexible and highly efficient. And when integrated with cranes or conveyors, they frequently are the solution to all handling problems in a plant. Rapid movement and costs as much as 90% below manual handling costs are advantages. Maximum utilization of storage space by stacking to the ceiling also is important.

Tractor-trailer systems provide low cost per ton moved over relatively long hauls, and handle large quantities. The trailers may be efficiently loaded and unloaded by power-lift trucks.

Nonlifting-platform power trucks are used principally in departments equipped with cranes and are a natural choice for transporting a limited number of loads over long distances. Low-lift trucks which can pick up skid loads of materials are widely used for moving relatively short distances, and where tiering is not required, as from machine to machine. High-lift trucks are necessary for tiering loaded skids in storage. Fork-lift trucks, which pick up loads on pallets, have come into wide use where tiering and carloading are factors, because the thin, space-saving pallets are preferable to skids in such applications. With special "forks" these trucks will handle drums, heavy reels, coils, tires, and other bulky or heavy objects.

The new motorized hand trucks are less expensive than regular power trucks, put less burden on floors, and operate in tight spaces. Lifting and tiering types recently have been introduced.

Boxcars and trucks now are efficiently loaded and unloaded at many plants by lift trucks which carry skid or pallet loads directly into the cars or trucks and stack them. Portable roller and belt conveyors also are used effectively for this purpose.

If by hand trucking a man can move 400 lb. per trip and make 20 trips per hour, handling costs, at $0.65 per hr, would be $0.1625 per ton. With five lift trucks hauling 4,000 tons a day, cost per ton would be $0.125 and saving per year (260 days) $156,000. Even this great saving in handling costs has been exceeded in actual cases.

Palletizing Progress

With the increasing use of fork-lift trucks, there have been many new developments in the design and use of pallets. Lightweight aluminum pallets, and inexpensive reinforced cardboard pallets have been developed. One truck manufacturer even has devised a truck for using flat corrugated cardboard as pallets. The load is stacked on the cardboard as it lays on the floor, then an at-

tachment on the truck pulls the pallet and its load onto the lift.

When unit loads are assembled on pallets, they often are steel-strapped for safe shipping. This permits the use of lighter, less expensive containers. A newer method of palletizing or unitizing loads of corrugated, solid fiber, or wood shipping cases uses glue to hold the cases together. The adhesive may be brushed on a portion of the container top before another box is placed upon it. But it is more efficient to apply the glue automatically by rollers as the containers pass along a conveyor. A case is easily broken loose from a glued pallet load by a sharp upward thrust.

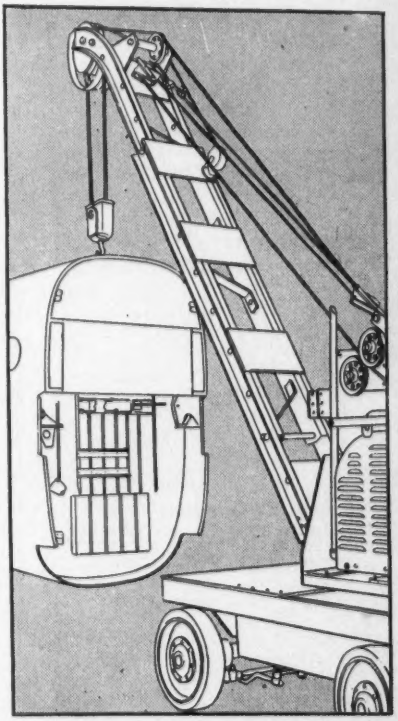
Just announced, a new machine takes cases from a conveyor and automatically stacks them in tiers on pallets.

Handy Cranes and Hoists

Cranes offer a flexible means of handling materials within their range. Thus, an overhead traveling bridge crane can serve the length and width of the area encompassed by its runways. A locomotive crane is limited to trackage available, jib and pillar cranes to their swing radius. Cranes mounted on trucks and tractors, however, are relatively unlimited in area of service. Simple hand-operated portable floor cranes are especially useful for setting up work in machines, handling dies, and other operations. But powered portable industrial-type cranes are more widely used, and are available in capacities up to 10 tons. With a power-operated, rotating, luffing, and telescoping boom, a tractor crane is extremely useful for many shop operations. Locomotive, truck, and tractor cranes can be equipped with blocks for general hoisting, grab or dragline buckets for handling loose material, and electromagnets for handling iron and steel.

Gantry cranes, supported by an inverted U frame on wheels, are used in the metalworking industries for loading, unloading and storing materials, in transferring heavy freight, and in erecting heavy work in shipyards. In many ports of the world, this crane speeds the loading and unloading of ships. It travels along the wharf, and the trolley on its lengthwise bridge operates outward over the ships' hatches. Employed where overhead crane runways are not feasible, the gantry is particularly useful where the crane itself does little traveling but transfers materials sideways by trolley. These cranes usually are built in 1 to 150 ton sizes, but 350 ton units are in use.

A widely used system of overhead



Flexible in their movements, tractor cranes are adapted to a wide variety of handling operations, both in storing and assembly.

transportation utilizes an I-beam type of rigid track, or monorail. The track is equipped with various forms of hoists and other carrying devices and serves both for lifting and transporting relatively heavy loads along its course, which may extend almost any distance and in any direction in a factory.

Fast Bulk Transportation

To permit bulk shipment of flour, sugar, and other granular and pulverized food products, an unusual system has been developed. The products can be shipped in 30,000-lb. stainless steel tanks, three tanks to a special flatcar. At the terminal, the tanks can be transferred mechanically onto automotive tractor-trailers for haulage to the bakery or other plant, to be emptied by a vacuum conveyor system. For plants with a railroad siding, special tank cars are used. A flatcar-to-trailer transfer also has been used in bringing fluid milk to metropolitan dairy plants with no siding.

At least one brewer hauls yeast and malt in tank trucks and unloads them with a pneumatic conveyor. Liquid sugar is hauled in tank trucks and pumped from street level into the food factory through a flowmeter.

A big time and labor saver which enables large automotive trucks to deliver considerably more material per day in short-haul work is the elevating tail gate. Power operated, the gate lowers to ground level and functions as an elevator to raise heavy objects to truck bed level, or to lower them from the bed to the ground.

Straddle Trucks Useful

Heavy, cumbersome loads, such as a pile of long large pipe, steel or wood beams, or ship plates are quickly picked up, transported about the plant or shipyard, or over highways, by the straddle truck. Described by its name, it is an automotive vehicle with a high inverted-U frame permitting it to straddle the load and pick it up by hoisting shoes.

Handling Cargo Quickly

Large, expensive terminal cranes no longer are needed for fast, economical handling of general cargo to and from ships equipped with powerful, speedy winches and sufficient booms. Efficient handling is attained if the terminal is equipped with pallets, fork trucks, tractors and trailers, and cargo masts. Since a trailer can always be in place under the hook of a ship's boom, the wide reach of a crane is not required. And the cargo masts will move materials to railroad cars on the second or third track of a terminal. With this system, handling is faster, and less capital is tied up. Electric pier winches are used with cargo masts in loading and unloading barges and lighters. These also speed operations when ships are not properly equipped.

An example of fast loading of ships with a special cargo is seen at Port Allen, Hawaii. Belt conveyors carry bags of raw sugar from warehouse to shipside. Elevators lift the bags to a conveyor mounted on a gantry crane, for positioning over the hatches. This conveyor discharges into chutes with swinging end sections that direct the bags onto chutes on either side of the hold. The bags are taken off the ends of these chutes and stowed manually.

Acknowledgment

Much of the information and most of the illustrations in this report are from *American Machinist*. Material also is taken from *Factory, Food Industries, Textile World, Chemical Engrg., Business Week, Mill Supplies*, and *Engrg. & Mining Journal*.

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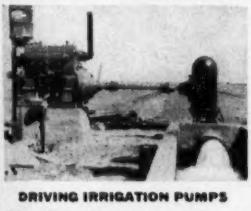

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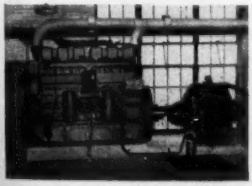

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By CHARLES L. AMICK, Lamp Department, General Electric Company. Approximately 300 pages. $4.00

The second edition brings up to date this manual, which was originally compiled to clear up the many confusions and misunderstandings incident to the introduction of the fluorescent lamp. Its goal is to compile in a single reference source the multitude and varying types of information necessary to design, sell, install, and service the fluorescent lighting installations which will be of greatest advantage to the customer and the designer or contractor. This latest edition contains much new material necessary to follow the rapid advances in fluorescent lamps and lighting techniques.

MATHEMATICAL THEORY OF ROCKET FLIGHT

By J. BARKLEY ROSSER, Professor of Mathematics, Cornell University; ROBERT R. NEWTON, Member of Technical Staff, Bell Telephone Laboratories and GEORGE L. GROSS, Research Engineer in Applied Mathematics, Grumman Aircraft Engineering Corporation. 276 pages. $4.50

Up to date, comprehensive, and definitive, this important new book has been designed as a handbook for the trained scientist with previous experience in this field and as a text for the reader with little scientific training, who is interested in "what makes a rocket go." Thus, while calculus is required for a complete understanding of the report, enough explanatory material has been included so that the layman may follow the continuity. The book is not intended for classroom instruction.

THEORY AND APPLICATION OF ELECTRICITY AND MAGNETISM

By CHARLES A. CULVER, formerly, Head of the Department of Physics, Carleton College. 594 pages. $5.00

Written by a successful teacher and science author, who is also a practicing engineer, this text is adapted for use in junior and senior undergraduate classes in arts colleges and as a first-year course in electricity and magnetism in engineering schools. The aim has been to present the material that may serve as a foundation for advanced study in theoretical physics and in chemistry and as a basis for work in electrical engineering. The text is generously illustrated and provides an abundance of graded problems.

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By SAMUEL P. BROWN, Staff Engineer, Coverdale & Colpitts, Consulting Engineers, New York. 644 pages. $6.00

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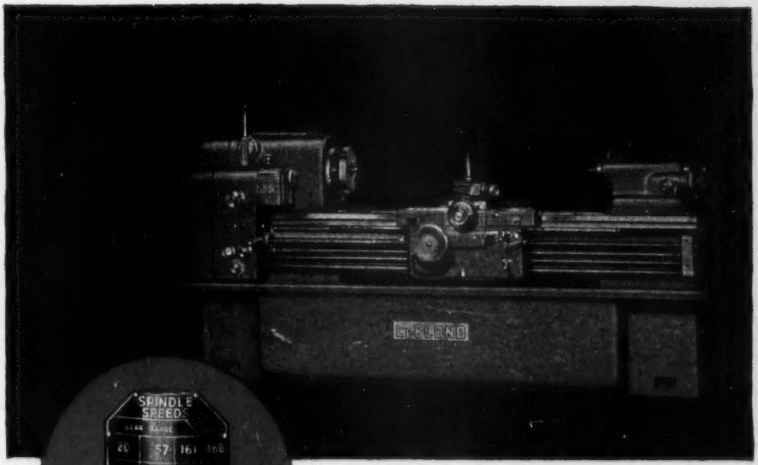

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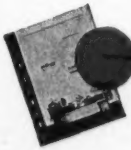

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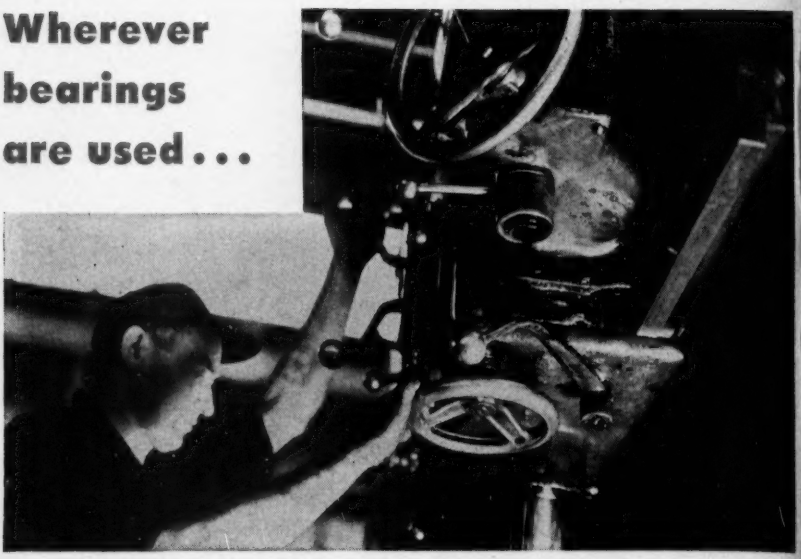

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